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Bicycle Tools—II.

WHEEL RIM TOOLS—CONTINUED.

The St. Nicholas factory is well up on the North side in Chicago, and, like several other large cycle shops, began with toy carriages, hobby horses, and other holiday wares, and was pushed into a condition of the highest activity by the tidal wave of bicycle popularity.

The St. Nicholas, Western Wheel, and they had previously put out, and they met this demand largely without resort to outside talent, and by decidedly original designs. Their previous lines of work included vast numbers of wheels for toy vehicles, and these in their better class of toys, children's tricycles, and so on, were made wholly of metal, very cheap, and also very good. The demand for the wood rim wheel was met by the St. Nicholas with the production of a rim-turning lathe and rim-sanding machine, each very low in cost, and very effective in operation, the rim-turning lathe making 420 outside cuts in 10 hours, which is about equal to the best production so far; the lightness of this St. Nicholas rim lathe tells against it, however, in the inside rim cut, where there is much more stock to remove than in the outside cut, only half as many, 210, rims being turned inside in 10 hours. This difference is probably due entirely to the fact that for the outside cut the rim is carried on wooden arms which give an efficient support in direct radial lines, while for the inside cut the support is overhung on light iron arms, not sufficiently backed up by the very small diameter chuck plate, or face plate, on which these wheel gripping arms are supported. The rough rim is made to a fixed size outside, and hence all the variations come on the inside, and the shape of the rim demands much more stock removal for the inside cut, so that much the greater part of the work of turning a wood rim is done on the inside cut. The Plymouth lathe, first pattern, probably weighs five or six times as much as the St. Nicholas lathe, and the Plymouth lathe makes the same number of cuts inside and outside, from 400 to 450 per day of 10 hours for each lathe; the Plymouth lathes are all alike, but are set up for either inside or outside cuts, and are not changed; they are worked in teams of two lathes and two men, the work passing from one to the other, two men with these heavier lathes producing as many finished rims per day in the Plymouth shops as three men can turn with the St. Nicholas lathes. The Plymouth lathe is not nearly confronted with the new problem of accurate finish in their work. Everything they made before the bicycle had, of course, sufficient accuracy to make parts perfectly interchangeable, but the gage limits were large, and the prices of toys are among the marvels of low-cost construction. The bicycle called for a very much higher grade of work than heavy enough in the frame, which is, as shown, of the weak web and rib construction, and is even now being replaced by a substantial box design. The St. Nicholas is not even a web and rib pattern; it is a built-up frame, grasshopper style, braced with small screwed iron rods; the Plymouth lathes are all braced with wood braces nailed to the floor, and both of these lathes are worthy of study as being cheap and effective, faulty as they are in some particulars.

Fig. 4 is a rear view of the St. Nicholas wood rim lathe. The frame consists of a flat top plate provided with boxes for the lathe spindle, and also having the front and rear members of its open "slate-frame" design extended on the right to take the rear end of the tool-slide support, which is bolted to the under side of these extensions in a very weak and insufficient manner. Wrought-iron round rod diagonal braces with screwed ends are added, and a more substantial flat iron brace, *A*, reaches from the front leg up to the inner end of the tool-slide support, all as very clearly shown in Fig. 5.

Referring to Fig. 4, two brake shoes *B* are supported on a pair of spring iron bent uprights which are connected by a cross bar *C* in front, and from this cross bar *C* a treadle rod *D* reaches down to the treadle *E*, all to insure the prompt stopping of the lathe when the workman's foot is applied at *E*. The tool post is a bolt *H* and U-strap *G*, by which the tool is clamped to the top of the tool slide *P*. *P* is furnished at its outer end

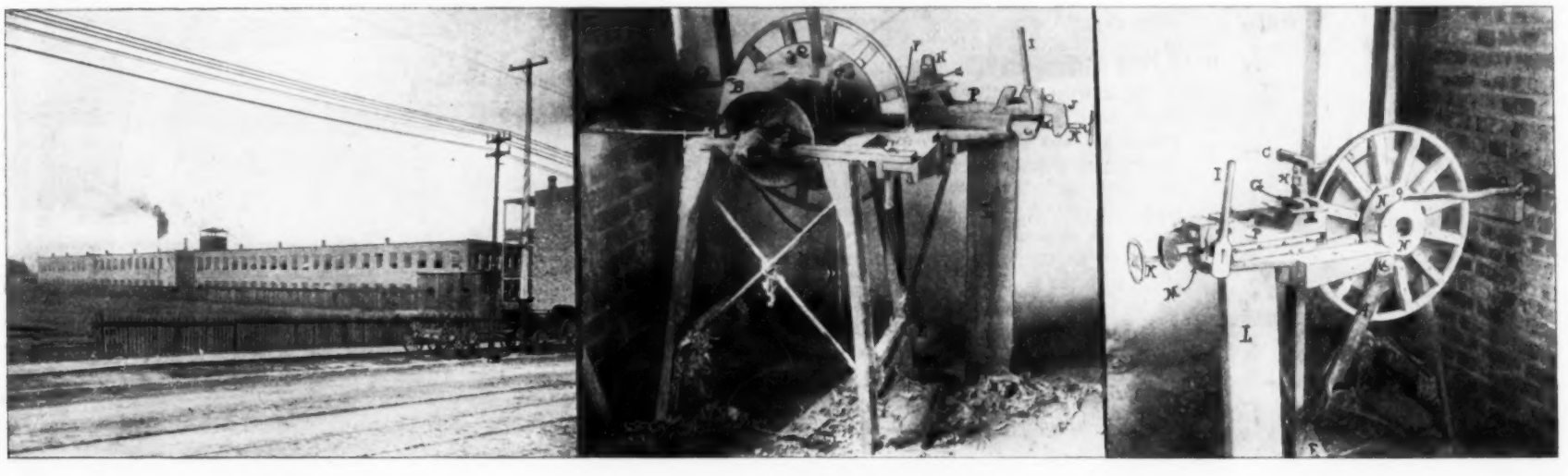


Fig. 3.

Fig. 4.

Fig. 5.

MAKING WOOD RIMS.

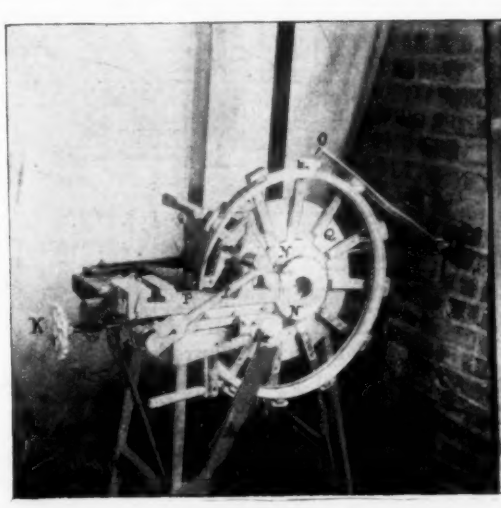


Fig. 6.

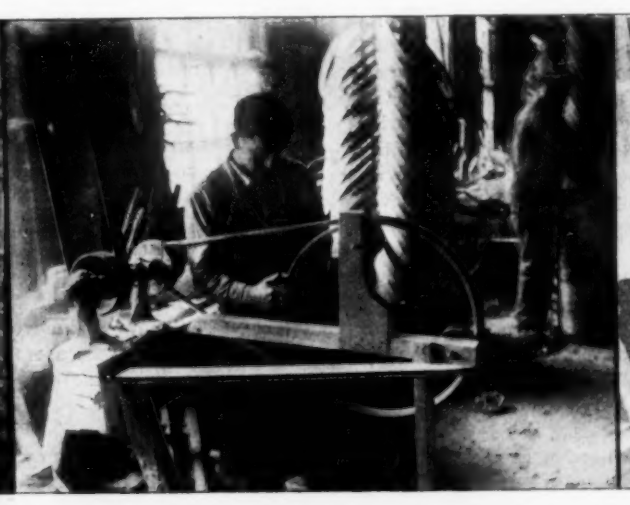


Fig. 8.

Fig. 9.

MAKING WOOD RIMS.

with a bracket *J*, carrying the stop screw *K*. In addition to the various iron braces to support the tool slide there is a substantial wooden post *L*, put under the slide bracket when the lathe is used for the outside cut. The tool is fed to the work by the lever *I* which carries a pinion *M*, working in a rack in the under side of the tool-post slide. The chuck is composed of four principal parts: (1). The outward extension of the lathe spindle threaded at its outer end to take (2) the large round nut *N;* (3) the disk *Q*, having radial guide ways for the sliding chuck jaws planed in it, and (4), the sliding jaws which carry the work. These jaws are moved in and out to grasp the work by the moving of the nut *N* on the spindle nose, as shown in Fig. 7. The disk *Q* is screwed up hard against the spindle collar, face-plate style, and has as many radial seats planed in it as there are to be chuck jaws used; these chuck jaws are held in place fore and aft by two screws in each, working in slots in the disk, not shown in Fig. 7, but plainly to be seen in Fig. 4. Each chuck jaw has on its front side a solid prong standing out from the jaw body at an angle of 45 degrees; the nut *N* threaded on the out end of the spindle has a groove cut in its inner face, also at 45 degrees, and of such width as to let the jaw prongs slide in the groove. The nut *N* has capstan holes drilled in it to take a tit on the substantial link *O*, which is hooked into a ring secured to the wall of the shop. Wood jaws to suit either the outside

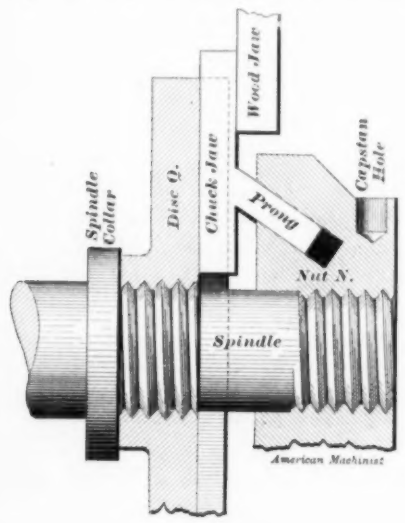


Fig. 7

or inside of a rim are screwed to the front side of the iron chuck jaws. In Fig. 5 the link *O* is shown hooked to the wall and having the tit on its inner end in a capstan hole in the nut *N;* if the chuck is turned by pulling on the chuck jaws or driving belt the jaws will be opened or closed by the action of the walls of the 45-degree groove in the nut on the faces of the 45-degree prongs solid on the chuck jaws. To make the chuck jaws they are first planed to thickness to slide in the radial seats in the disk; they are then screwed in place in the disk, and the 45-degree prongs are turned off on their inclined faces in the lathe. This makes these inclined faces fit the groove in the nut *N*, and while the friction due to the 45-degree angle is undoubtedly great, the hold of the chuck is ample for the work. This rude lathe and its chuck are so minutely described because the lathes, perhaps, cost as little as any efficient lathe for the purpose which could be made, while the chuck is very seldom seen; it may be old: the ordinary old-style twist-drill chuck involved a similar action of inclined faces; this St. Nicholas chuck, however, forces the jaws either in or out, and so can hold either by exterior or interior surfaces. The lathe has a brake for a quick stop, a quick and powerful tool-slide action with a gage screw stop, and thus involves all the useful features of such a tool. The Plymouth rim lathe is a very much heavier and better made tool, and yet the St. Nicholas turns off the same number of outside rim cuts as the Plymouth, showing that the St. Nicholas has all needed facilities for expeditious work. The trained machine tool designer will find it hard to understand how the clear-headed, right-thinking, analytic mind, which planned the St. Nicholas rim lathe, could possibly tolerate its slipshod construction, but this is an easy riddle; first, the lathe was put up in the greatest haste to meet the failure of contractors to deliver finished rims to the St. Nicholas; next, the policy of the St. Nicholas is to build all tools at low cost, especially those which are new and untried, as was this lathe.

The tool for making the inside cut has a large round shank passed through a round-eyed tool post and resting in V-blocks on each side of the tool post, as clearly shown in Fig. 6. The cutting bit of the tool stands at right angles to the shank, and so can be turned to stand at any desired angle to the surface of the finished cut, which is an important feature.

After turning the wood rim has to be "sanded," or rubbed with sand paper, which is a very slow operation if performed altogether by hand. While the St. Nicholas drawing room was considering the problem of the sander the superintendent took two common cast-iron door hinges, or "butts," two little machine bolts, two grooved wooden rollers which cost about fifteen minutes work of a wood-turner's lathe, four pieces of hard wood, and an old solid rubber tire, and applied this 50-cent lot of stuff to an unused wood-turning lathe as shown in Fig. 8. The weight of this absurdly cheap rig holds it down against the pull of the rubber tire driving belt, and when a rim is "sanded" smooth the boy puts his left hand under the frame at *F*, Fig. 9, where the tips of two of his fingers can be seen, and lifts the hinged frame up enough to take the belt out of its grooved driving pulley on the nose of the wood lathe and takes the belt off with his right hand, puts the rim on the pile seen in the rear, and hangs another rim on the grooved rollers, puts on the tire-driving belt and goes ahead with the sand paper. The St. Nicholas designer told me he was hoping to find a design for a sander to cost inside of a hundred dollars, and that he laid the whole matter aside in deep disgust when he saw this effective 50-cent rig in operation the same day he began to hunt for his hundred-dollar economy on the drawing board. As the designer at the St. Nicholas is one of the two proprietors he could well afford to laugh at the discomfiture of technic art, and to remark that when he could think of a cheaper sander to do more work he might take hold of the job once more.

Hugh Dolnar.

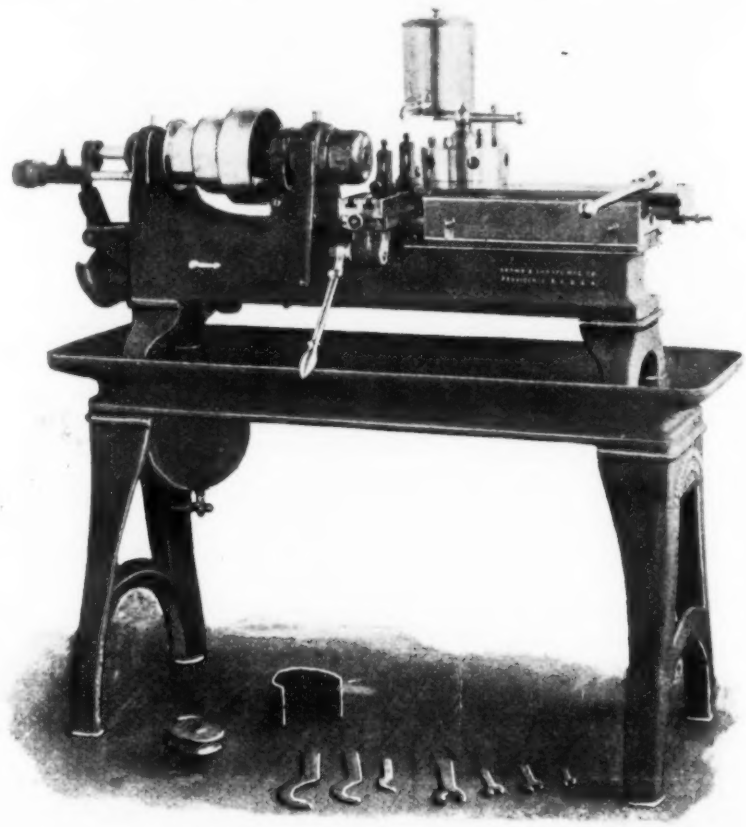
Screw Machine with Automatic Rod Feed and Chuck.

Our illustrations on this page will serve to make plain the construction and method of operation of a screw machine, which, in addition to the usual functions performed by such machines, automatically opens its chuck, moves the rod or stock forward the required distance for the next piece, and closes the chuck upon it again, all this being done within a second of time, and with practically no exertion upon the part of the operator, the only thing he needs to do being to slightly depress the small lever seen in front of the machine below the cone pulley. This throws the chuck operating and feeding mechanism into action, and, incidentally, one hole of the turret is gained, because, owing to the accuracy with which the stock is fed forward, no stop is necessary in the turret, and the time required to bring the stop into position is also saved.

Referring to Fig. 2, which is a longitudinal section of the head stock and spindle, it will be seen that there is a quill *A* which is fitted into the spindle and has threaded into it, at its right-hand extremity, a split collet *B*, which is spring-tempered and grips the rod tightly enough to move it, except when the rod is held by the chuck being closed upon it.

When a piece of work has been made, and the small lever previously referred to is depressed, this collet *B* is first drawn back upon the rod a definite distance required for a new piece, the rod being held by the chuck which remains closed. The chuck is then opened, freeing the rod, and the collet *B* is advanced to the position shown in Fig. 2, when the chuck is again closed.

The chuck is composed of the hardened and ground split steel collet *C*, the position of which is defined by the cap *D*, which is threaded to the spindle, and after adjustment can be clamped at any desired position by the screw *s*. The collet is closed by the endwise movement of the hardened and ground quill *E*, which slides within a hardened and ground steel ring at its outer end, and as the collet *C* does not move endwise in opening or closing, but is held by its square shoulder against the cap *D*, it has no tendency to move the stock endwise, and its position is always the same regardless of



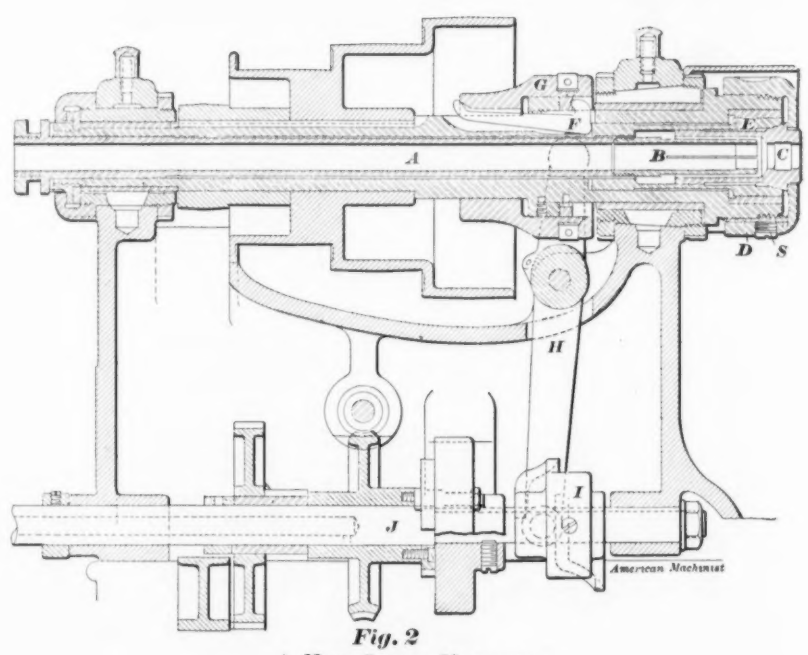


Fig. 2

A New Screw Machine

such variations in diameter of stock as are inevitable. The quill *E* is moved forward by three levers, which are operated by the sliding ring *G*, which is moved by the lever *H* and cam *I*.

This cam is upon a shaft *J*, Figs. 2, 3 and 4, upon which shaft is a worm wheel which turns freely upon it, being driven continuously by the worm *K*, Fig. 3, which derives its motion in the manner indicated by a separate belt from the countershaft, so that the feeding, chuck closing, etc., are done at a uniform and maximum speed, regardless of the speed of the main spindle.

On the same sleeve with the worm wheel is a steel ratchet wheel *L*, which, of course, revolves continuously in the direction shown by the arrow, Fig. 3. At the side of this is a steel disk *M* keyed to the shaft, and upon this disk is a pawl *N*. When this mechanism is at rest the pawl is in the position shown, and the spring plunger *O* is engaged in a notch in the edge of the disk, as shown, holding it and the shaft stationary, but when the small lever previously referred to is depressed, the trip *P* swings laterally (toward the observer in Fig. 3) and allows the spring plunger *R* to throw the pawl into engagement with the ratchet wheel, and the shaft *J* with the cams *I* and *S* (the latter seen in Fig. 4) revolve. As soon as the lever is depressed it is to be immediately released, and a spring returns it to its normal position, so that when the pawl has made one revolution it is released by again coming in contact with the trip *P*. During this revolution the functions described are performed by means of the cams and levers *H* and *T*. But if the trip lever be touched and very quickly released, the pawl is allowed to engage as before, but it then almost immediately comes into contact with an inclined surface, shown by the dotted line on *P*, and is drawn out of engagement again. This is done just as the second notch *a*, in the disk, reaches the spring plunger *O*, and during this fraction of a revolution the effect is to open the chuck only. This enables the operator (or a spring placed in the chuck) to remove the work, and a new piece being inserted, a second touch of the lever completes the revolution and closes the chuck. This, of course, is for finishing the ends of pieces, or for performing the second operation upon them.

The lever *T* (Fig. 4) always moves the same distance, and advances the feeding

quill *A* to the same position, but the distance this quill is drawn back, and consequently the amount of feed, will depend upon the adjustment of the dovetailed steel bar—which has a square thread on its outer cylindrical surface, and is moved endwise and held in any desired position by turning the internally threaded collar *e*, which is placed between two fixed collars. The extreme movement of the quill is 3 inches, and withdrawn from the spindle when desired. When desired, an ordinary chuck can be used on the spindle for finishing castings, forgings, etc., and it will be noticed that there is a plain bearing for the chuck in addition to the screw threads.

Fig. 5 is a cross-section of the bed showing the arrangement of cross slide, stops, and tool posts. The wedges for vertical adjustment of the tools are shown at *w*. The center of turret holes to top of slide, 2 inches; greatest distance from turret to face of chuck, 9½ inches; swing over bed, 10½ inches; over slide rest, 4½ inches; length that can be turned, 4 inches. The machine has hardened and ground steel spindle running in bronze boxes. It weighs about 970 pounds, and is made by the Brown & Sharpe Mfg. Co., Providence, R. I.

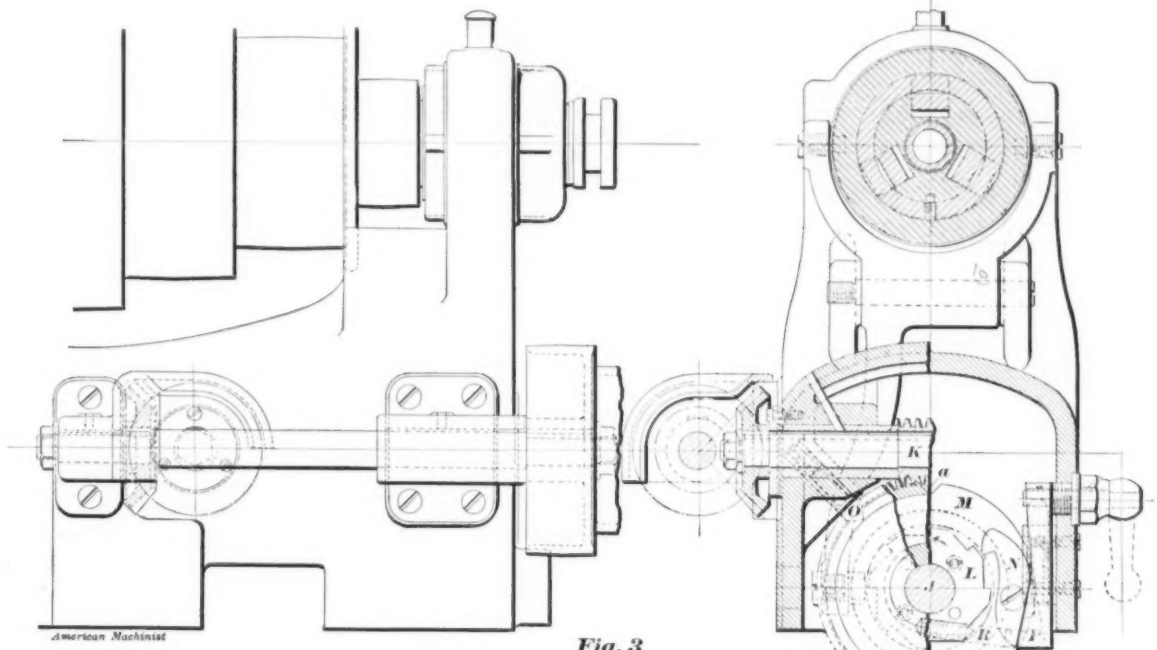


Fig. 3

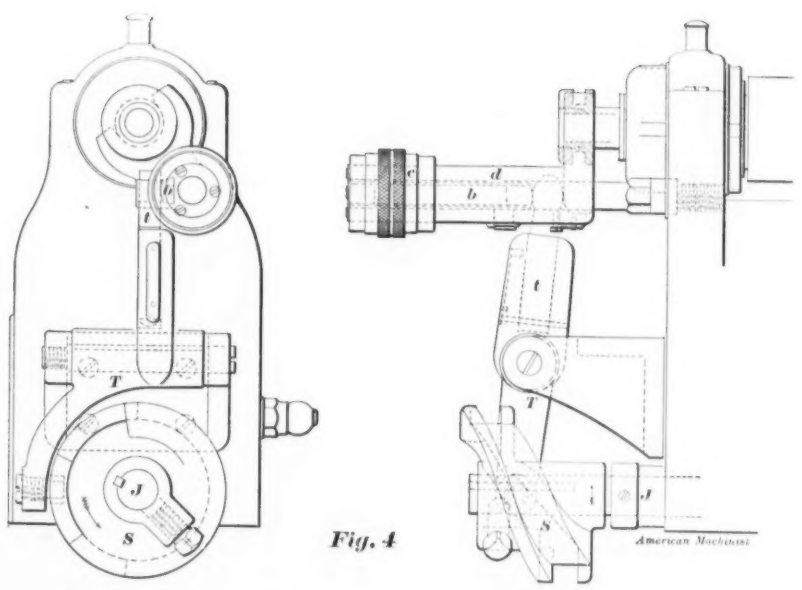


Fig. 4

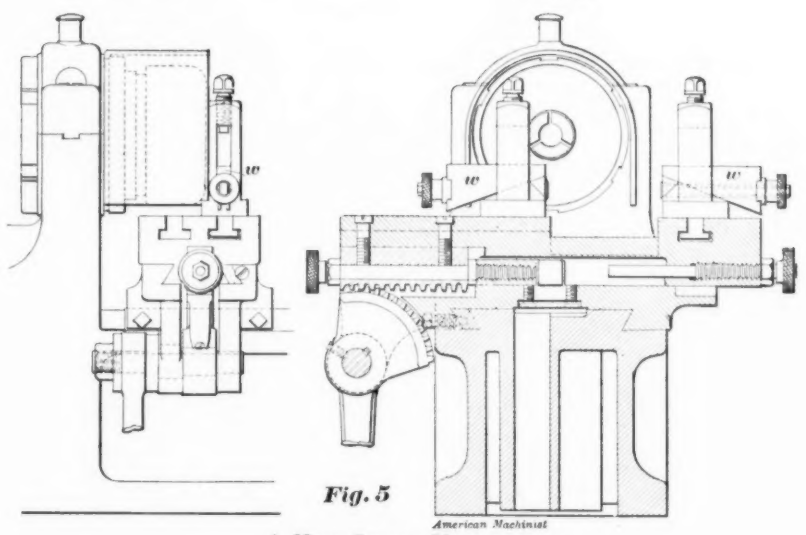


Fig. 5

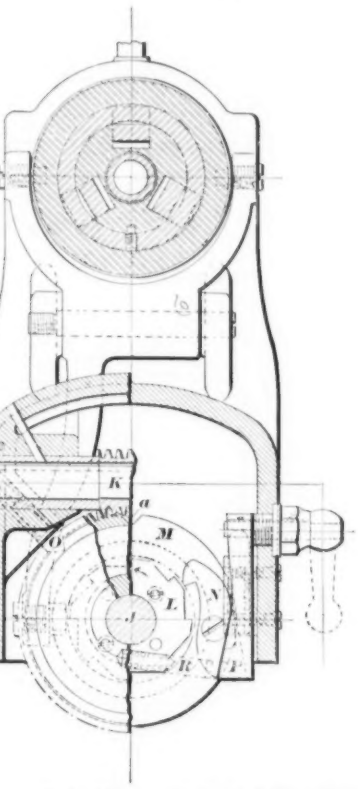
A New Screw Machine.

by moving the piece *b* backwards to allow the lever *T* more play, the movement of quill and consequently the feed of the rod are reduced to any desired amount, while if it is desired to feed more than 3 inches, the required distance can be made in two or more movements of the lever.

The lever *T* is composed of two parts, *t* being a piece of steel hinged upon the small pin shown, so that it can be swung out laterally to clear the sliding sleeve *d* and allow this sleeve and the feed quill *A* to be adjusting screws are flatted on each side, and pass through the slot as shown, the knurled nuts serving to advance the wedges to any required position. Knurled head screws below, with check nuts, act as stops in each direction.

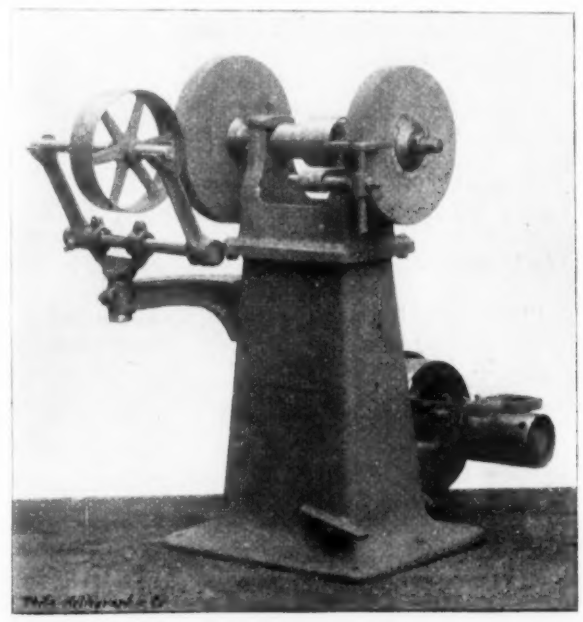
When desired, the machine is fitted with power feed for the turret, and the small pulley seen on the spindle at the left of the cone pulley is for driving this feed motion.

The cone is for a 2¼-inch belt; turret has six holes 1 inch diameter; distance from



Grinding and Polishing Machine.

The accompanying illustration shows a new grinding and polishing machine recently brought out by the Appleton Manufacturing Company, 30 Thompson street, Philadelphia. The special feature of this grinder is in the universal adjustable mounting for grinding all forms of circular work. The cut shows a pulley in position for grinding. A bracket is bolted to the standard of the machine, or to the head where bench machines are used, and a swiveled yoke stands in an eye in the bracket. The two split eyes of the yoke carry a horizontal shaft which may be clamped in any position desired. Upon this shaft are secured two arms with open Vs at their upper ends. These arms may be fastened upon the shaft in any position. The article to be ground is mounted upon a mandrel that drops loosely into the Vs, and it may be revolved in contact with the wheel until ground as required. Articles may be held by chuck or otherwise on the end of a mandrel, and hung outside the arms with a collar bearing against the V, and taking the thrust of the piece as it is pressed against the wheel. For large work, such as pulleys, an arm or brake is provided arranged to engage with the pulley by pressure of the body of the operator, both hands being left free to handle the work. This brake is not shown. The machine is made in several sizes, and with a variety of rests and attachments for the wheel on the other end of the arbor.



Grinding and Polishing Machine.

A Centesimal System of Circular Notation.

A system for subdividing the circle and also for recording or measuring time is proposed in the *Revue Scientifique*, by M. H. de Sorronton, the purpose being to bring this work as nearly as possible in accord with the metrical system. The hour as the fundamental unit of time is to be retained because of its universal adoption, its convenience, and the hopelessness of an attempt to change it. The hour is to be divided into a hundred minutes, and the minute into a hundred seconds. The new minute thus becomes three-fifths of the present minute, or thirty-six seconds, while the new second is three-fifths of three-fifths of the present second, or a trifle over one-third. Two of the new seconds would cover the time of a brisk step, like the accelerated pace used in the French army. A pendulum beating the new seconds would be 12.9 centimeters, or 5.079 inches, long. By this system any time may be conveniently expressed in hours and decimals, and additions and subtractions become much simpler than under the present method. The figures 9.3769 would be read 9 hours, 37 (new) minutes, and 69 (new) seconds. Clock and watch faces would be subdivided into 24 hours, but the divisions for the minute and second hands would be hundredths of the circle instead of sixtieths. The minute divisions would only coincide with the hour divisions at four points of the circle. It is not clear why precisely the same system should not have been recommended for the measurement of angles. It is, however, proposed to divide the circle, first into 240 degrees, and the degree into 10 minutes, while the minute is divided into 100 seconds, as with the clock face. The degree therefore does not coincide with the hour, while the minutes and seconds of time and of angles correspond. The only difference is in the location of the decimal point, and this, it would seem, must lead to confusion. Taking three hours, twenty-five minutes and seventeen seconds from noon the time would read 3.2517, but the angle traversed would read 32.517.

False Economy in Foundry Equipment.*

By H. H. Hansen.

The term economy poorly fits too many of the savings made in the foundry. Not everything that makes a saving possible is economy. The best is the cheapest, but some founders act as if the cheapest is the best. In some foundries a penny is saved and a dollar is lost. American tools did not find universal approval through the efforts of isolated village mechanics nor by each shop contriving for itself, but by a concentration of skill and experience. Shops that make their own tools are getting scarcer. Making a special study of the needs of each industry has furnished better tools and decreased their cost. The machine shop that should build a lathe or a boring mill for itself would find that it cost more, and was not as good as the lathe of the tool builder.

* Condensed by the American Machinist from a paper read before the Western Foundrymen's Association, Milwaukee September 18 1895.

The manufacture of foundry tools is becoming a trade of itself, and superior appliances are being developed. Chaplets which the foundry used to get from the nearest blacksmith, and which have caused the patching or the rejection of more castings than any other thing of their size, are being made by special methods and produced in superior condition and at a price that would not keep the blacksmith in tobacco.

Not long ago the writer was employed by a firm who chose to make a grinder rather than buy one. The foundry foreman was ignorant of this class of work, so the main casting was made three times. The smaller parts fared the same, and hardly a piece was made right on the first trial. When it came to assembling several pieces refused to go together. When last seen they were dust-covered relics of mistaken enterprise and economy, and though times were then dull and shut-downs in order, the firm who were going to make this machine so cheap, were then saying nothing about finishing it up ready for work.

About the same time another foundry realized that they must have a new crane. From figures furnished by dealers in foundry equipments they learned that a crane would cost something. They had the men and materials, why should not they build the crane? They knew nothing about that line of work, so a well-paid man was set to gather information on the subject. After a month spent in visiting various cranes and getting dimensions and figuring on details, they were ready to begin making patterns and borrowing and picking up makeshift parts. They actually got the crane to work. Power is money, and saving power is saving money, and if this foundry built a crane for 25 per cent. less than one could be bought for, while it constantly took 25 per cent. more power to operate it, where was the economy? Most foundries do not achieve success as amateur tool builders. They may for a time be deceived, yet we all know how soon a dollar's worth of extra labor may be consumed on a crane or other tool. Such leaks are common and increase the cost of every pound of castings, but seldom is an effort made to locate them. There might be unsavory disclosures endangering the position of a designer trying to minister to the wants of people with whose requirements he was unfamiliar.

It is a false economy that suggests to many of our foundrymen to-day that labor-saving tools may be made at home and reach the same degree of perfection attained by builders who devote their whole time to tool building. Not one foundry in ten can produce a creditable tool, simply because such an attempt involves the entering of strange fields where experience must be largely paid for in failures.

Plates of Uniform Strength.

By Albert E. Guy.

SECTION 12.

RIBBED PLATES—CONTINUED.

The cylinder bottom may also be made hollow with two webs bound by a number of radiating ribs in the manner shown in Figs. 25, 26 and 27. In this case the thickness of the plate can be less than that of the preceding example. If we make $h = \frac{1}{2}''$, equation (113a) gives:

$$n = \frac{2 \times 20''}{(\frac{1}{2})''} \cdot \sqrt{\frac{100}{3{,}000}} = 14.6;$$

in round number $n = 15$ ribs.

The radius of a circle inscribed within two adjacent arms or ribs and an arc of circle of radius $R = 20''$, is by equation (113),

$$3.''354 = \tfrac{1}{2}'' \cdot \sqrt{\frac{3}{2} \cdot \frac{3{,}000}{100}}.$$

By equation (114),

$$\sin.\left(\frac{180}{n}\right) = \frac{3.354}{20 - 3.354} = 0.2015,$$

which corresponds to an angle of $11°.\frac{63}{100}'$. Hence the number of ribs is,

$$n = \frac{180}{11.63} = 15.47;$$

in round number $n = 16$. This is rather an excessive value, but foreseeing the objections of some timorous people who think that an uneven number of ribs is producive of uneven strains in the cylinder bottom, and although their objections can be easily disposed of, the depth of the ribs will be calculated in function of the two values of n, *i. e.*, 15 and 16.

Consequently, if the plate is composed of 16 systems of ⊏ or I sections, the moment of resistance of one I section is,

$$\frac{M}{16} = \frac{f}{6} \cdot \frac{b\,d^3 - b_1\,d_1^{\,3}}{d}.$$

By equation (16)

$$M = 0.2929\,\pi\,x^3\,p.$$

For convenience sake let us make,

$$a = \frac{0.2929\,\pi\,x^3\,p}{16} \cdot \frac{6}{f} = \frac{b\,d^3 - b_1\,d_1^{\,3}}{d},$$

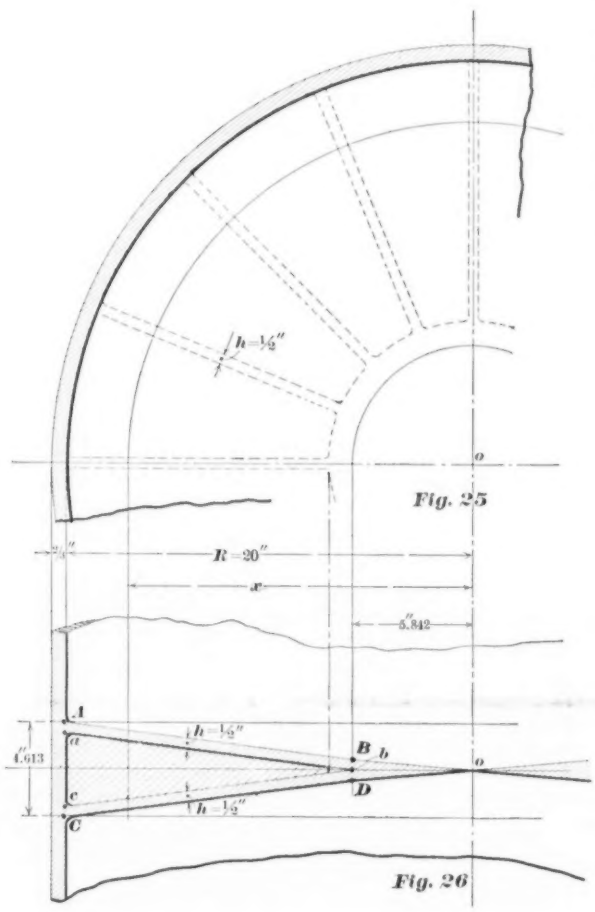
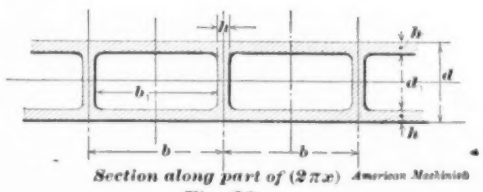


Fig. 25

Fig. 26



Section along part of ($2\pi x$) American Machinist

Fig. 27

If a closer approximation is found necessary, the value thus obtained may be introduced in (Eq. 121), which will then almost exactly express the real value of d.

Thus, when $h = \frac{1}{2}''$, $R = 20'$, $n = 16$ ribs, we have for the first approximation, $d_0 = 4.''671$, and finally $d = 4.''613$.

When $n = 15$ ribs, $d_0 = 4.''688$, and finally $d = 4\frac{5}{8}''$ very nearly.

Remark.—The thickness of both webs has been made the same, although one web only is subjected directly to the pressure acting in the cylinder. It is not necessary to always make it so, except for convenience; if desired, the bottom thickness may be a fraction m of the top web, which fraction can easily be introduced in the original formula, and the value of d determined without additional difficulty.

Rule.—For a hollow circular bottom cover composed of two plates firmly fixed along a circumference of radius R, and bound together by a number of radial ribs whose shape must be determined, their thickness being known and assumed to equal that of the two webs:

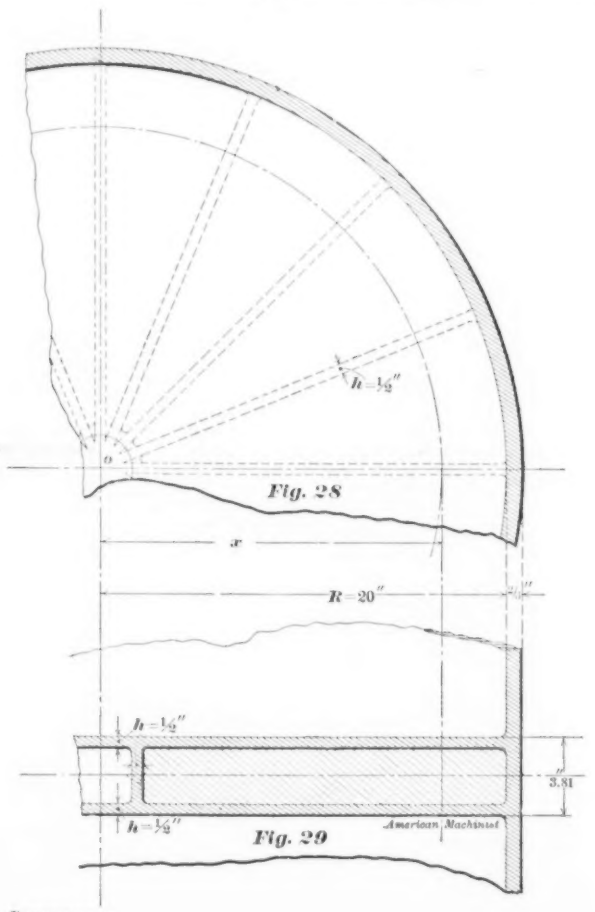


Fig. 28

Fig. 29

PLATES OF UNIFORM STRENGTH.

and assume that the webs and ribs have the same thickness $h = \frac{1}{2}''$. Hence we have,

$$b - h = b_1,\ d - 2h = d_1.$$

Hence,

$$a = \frac{b\,d^3 - (b-h)\,(d-2h)^3}{d}.$$

This equation after proper reduction becomes,

$$\frac{a}{h} + 12\,b_1\,h - \frac{8\,b_1\,h^3}{d} = d^2 + 6\,b_1\,d,$$

and thus can be treated like any equation of the second degree.

Consequently, after completing the square of the second member, we have

$$(d + 3\,b_1)^2 = \frac{a}{h} + 12\,b_1\,h - \frac{8\,b_1\,h^3}{d} + 9\,b_1^{\,2},$$

from which is obtained the value of

$$(121)\quad d = -3\,b_1 + \sqrt{\frac{a}{h} + 9\,b_1\left(b + \frac{h}{3}\right) - \frac{8\,b_1\,h^3}{d}}.$$

In most cases the term $\left(-\frac{8\,b_1\,h^3}{d}\right)$ may be neglected and d determined by (121) simplified as follows:

$$(122)\quad d_0 = -3\,b_1 + \sqrt{\frac{a}{h} + 9\,b_1\left(b + \frac{h}{3}\right)}.$$

1. *Find the greatest hight d of the cover by equation* (122):

$$d = -3\,b_1 + \sqrt{\frac{a}{h} + 9\,b_1\left(b + \frac{h}{3}\right)},$$

which will always give a slightly excessive value of d; if closer approximation is wanted introduce this result in (*Eq.* 121), *which will give almost exactly the real value of d.*

2. *Find distance B O* (Fig. 26) *from equation* 20, *section* 2, *viz.:*

$$B\,O = \sqrt{\frac{1.138\,f\,h_1^{\,3}}{p}}.$$

(In the present case $h_1 = 2\,h = 1''$, and $B\,O = 5.''842$), *then draw straight lines joining A and B, C and D; draw parallel lines a b, b c distant a length h from A B or B C, and the required shape is thus established.*

At $B\,D$ there is a thickness $h_1 = 2\,h$ which decreases thence to zero as has been demonstrated in previous paragraphs. The cover is represented in Fig. 26 as a solid of uniform resistance, but it cannot be adopted in practice. Generally the two webs never meet and the ribs are diametral. However, the present solution of the problem may be found useful as a guide for determining the greatest *necessary* hight of the ribs, and what may be called their minimum shape.

It is important to remark that holes must be provided for holding in place the cores and removal of such after casting, and in consequence the section of the webs of the covers is greatly diminished at some places, at which provision must be made for insuring ample strength. It will be easy to modify the shape of the cover to suit the conditions required, as the modulus $\left(\frac{I}{a}\right)$ of the reduced section can be readily determined by equating its symbols to the bending moment affecting the section.

When the cover is made of uniform depth, it is less economical but more easily made than as described above. Such a cover is partly represented in Figs. 28, 29 and 27.

The depth d is determined by combining the equation of the bending moment (119) with that of the modulus of the section. Thus we have:

$$M_0 = \frac{0.226272\,p\,\pi\,R^3}{(n=16)} = \frac{f}{6}\,\frac{b\,d^3 - b_1\,d_1^{\,3}}{d};$$

whence $d = 3.''81$, when the thickness of the webs and ribs $= \frac{1}{2}''$, the radius $R = 20''$, the pressure $p = 100$ pounds and $n = 16$ ribs.

As a great number of ribs causes a lump of metal to be at the center of the cover, if necessary, part of it may be removed, as shown in Fig. 29. The small cylinder at center must, of course, be cored out, but the extra work required may be amply compensated by insuring a sound casting.

Concerning Testimonials.

By W. H. Wakeman.

Was there ever an engine so poorly made that its builder could not secure a testimonial from some one setting forth its good qualities in an enthusiastic manner? Was ever a boiler so poorly designed, so complicated in its construction, so dangerous to operate, or so wasteful of fuel, that no one could be found who was willing to state that said boiler was the best one known to date? Is there a pump or injector made that is of so little value that no one can be found to praise it? And then as to lubricators, are they not all first-class in every respect, according to the opinion of somebody who has either used them or seen them used? And so on through the whole category of steam appliances, for not one of them is so mean as to find none to do it homage. Why is this true, when there is such a difference in the quality of all of these machines and appliances? We assume that all men are honest in giving these

documents, and free from mercenary motives, so that it only remains for us to note some of the mistaken ideas under which they labor, and the different standpoints from which they view matters. Let us take the engine first.

A man who knows nothing of steam engineering buys an engine to run his factory. It is installed, and a first-class laborer put in charge of it, after receiving instructions for half a day as to what his duties are. As the engine is very simple in design, and the laborer a fairly intelligent man, he gets along very well; for when he wishes to start up he opens the throttle valve, and when he wishes to shut down he closes it, and between those times he keeps the machine well oiled, which is all very well, but he uses more than 60 pounds of water per hour for each horse-power developed, and burns 10 pounds of coal to do it. Of this neither the so-called engineer nor the owner of the plant knows anything, and if some expert should tell them just what they were doing, they would not know that the best possible results in every way were not secured in their practice. Nevertheless, when the builder of the engine comes along and makes inquiries concerning the performance of the machine, they are loud in its praise, and are ready to sign any testimonial that may be written out and presented to them.

Again, such parties may wreck a good engine through ignorance of some of the most ordinary duties of a stationary engineer, and then blame it all to the engine and its builder.

Quite frequently testimonials are given, which state that a certain engine has been run for several years without repairs of any kind. This is all very well so far as it goes, but it does not convince us that no repairs are needed. A certain engineer boasted that his engine had run for 20 years at an expense of 50 cents for repairs, but an inspection of the machine soon convinced me that it needed about $200 worth of repairs at that time, so that the statement of the engineer was rather misleading as to the real condition of affairs.

Concerning testimonials as to the performance of boilers, the following extract is submitted as a sample, although a rather extreme case:

"I find that its consumption of coal is much less than the others, and there being no tubes, steam is more quickly generated and maintained, and much more water evaporated, owing to the fact of the great surface exposed to the fire. Its simplicity of management is also greatly in its favor." Here is a man who claims that steam can be more quickly generated in a boiler without tubes than in one which has them, which is contrary to all accepted theory and good practice, for where there are many tubes the water is broken up into small divisions, and the heating surface comes in direct contact with a much larger portion of it, and so it is more efficient, but in this case it is claimed that by having a large body of water over the fire steam is more quickly raised and maintained, and I suppose that many who read it will have no doubt of its truth. It is usually understood that the more tubes a boiler contains the larger will be the surface exposed to the fire, but here the contrary is taught evidently.

In other cases boilers that are complicated, and consequently hard to clean and repair, are found to be very efficient when new, but after a time many of them find their way to the scrap pile long before they have lived out their allotted time, and yet there are always some ready to praise them. Some of the so called safety boilers are not altogether worthy of the name, because they have large drums filled with water and steam, and if one of these should fail the result would be as disastrous as if a plain cylindrical boiler of the same size should explode. These boilers have banks of water tubes attached to them, and if one of these tubes fail it does not cause a disastrous explosion, neither does it when one of the tubes in an ordinary tubular boiler can no longer stand the pressure that is put upon it. Testimonials are sometimes given to the manufacturers of such boilers, which state that they are not explosive, but, with all due respect to the parties concerned, it may be only just to say that some of them do not know whether such a statement is wholly true or not. Disastrous explosions of boilers occur every month, and it is quite probable that their owners would have been willing to make a written statement to the effect that they were safe from accident an hour before they took their departure, but disaster came, nevertheless.

Several years ago a tubular boiler exploded in the city in which my engine room is located, and several lives were lost. When the factory was rebuilt, a boiler was put in that its makers claim is non-explosive, and its owner was ever ready to give testimonials to that effect, but whoever goes into that boiler room now finds a common tubular boiler, although the same man has been chief owner and manager all of the time. Does not this prove that his faith in its safety was badly shaken? Is it not true that some of our boiler insurance companies occasionally have to pay heavy damages on account of the behavior of non-explosive boilers?

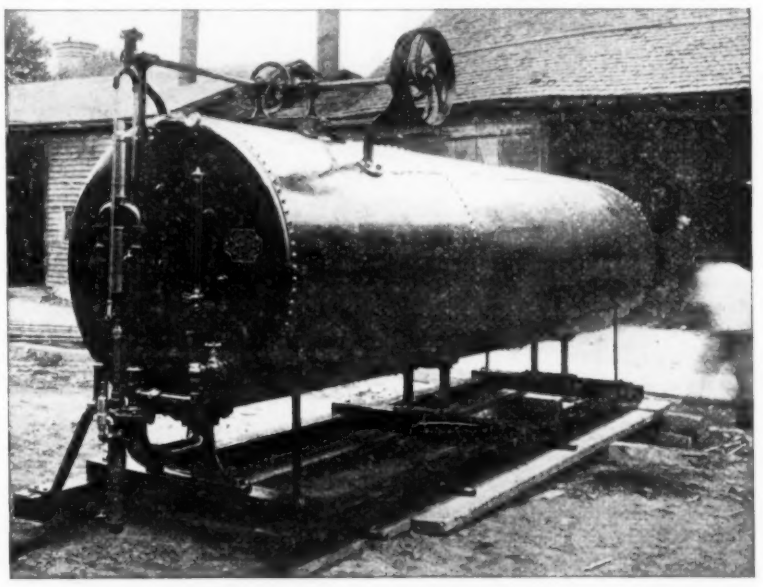
A short time ago a man came into my engine room with a lubricator that he was apparently very anxious to dispose of. It was one of the "here-to-day-and-gone-to-morrow" kind, and yet he stood ready to prove that he had induced a large corporation to adopt them in preference to well-known and standard brands. This being the case, what was the cause of it? It could not be on account of superior quality, for it possesses none, and as it was the man that sits in the office and pays the bills that adopted them, and not the engineers who use them, I am certain that it was on account of the comparative cost and nothing else. However, their testimonials look and sound just as big as if they were worth something.

And, then, when we come to injectors, what an array of different kinds are presented to our view. They are not all of equal value, for some of them are only worth the price of old brass, minus the cost of the time consumed in trying to make them work, and yet all can show testimonials telling of their great value.

So it is with almost everything that is manufactured, for none are without their advocates. It is an axiom that we should not be hasty about condemning the existing order of things, unless we can suggest some improvement, and as this is no exception to the general rule, I suggest that instead of depending on testimonials that are printed by the wholesale, it would be much better for parties who wish to purchase steam machinery to make inquiries of men who are using the kind that it is proposed to purchase, and first be satisfied that said men have used other kinds, so that they are qualified to judge, and secondly, note carefully their objections to them, so that the influence of their surroundings may be taken into account, for these are often large factors in the calculation, and thirdly, when you are talking with a practical engineer as to the value of an engine or a boiler, do not state the difference in the first cost of those under consideration, nor even intimate that there is any, for this is an insignificant item when compared with efficiency in the long run, and, moreover, it is something that really does not concern him in the least, for it is his business to run the machinery and get the best results from it, leaving the financial part of the question (so far as first cost is concerned at least) to the care of others.

Compressed Air Water Works.

In establishing and maintaining a water supply where the water is to be pumped and stored for use with sufficient pressure to flow to the upper stories of buildings, or to use for watering streets and lawns, or for fire service, the most perplexing part of the problem is in regard to the water tank. The elevated tank has been hitherto the most indispensable feature. With the necessary support and connections it is always costly and ugly, and in winter causes unceasing trouble and uncertain service on account of its freezing up. The pneumatic system which we illustrate does away with the elevated tank entirely, and instead of the warm water of summer and the frozen pipes of winter accompanying the old system, the water is stored in a tank placed underground, or in any convenient place where it may be protected from the vicissitudes of the weather. The tank is provided of sufficient capacity, or for a large service any number of tanks may be connected and placed wherever may be most convenient, regardless of any considerations of pressure from gravity. The pumping apparatus, which may be operated by hand, by wind mill, by gas, oil or steam engine, or by any available power, comprises both an air and a water pump. The tank is first pumped up with air alone to a pressure of, say, 20 pounds gage, and after that the air and water pumps work together. When the tank is from two-thirds to three-quarters full of water, as shown by a gage glass, the air pressure will be from 75 to 100 pounds, and all the water can then be drawn from the tank, and at the last there will still be a pressure upon it of 15 or 20 pounds. The proportion of air employed and the pressure carried may be varied to suit the circumstances When the tank is once filled with air at suitable pressure, it might be thought that little or no more air would be required, but it is found that more or less air mixes with the water, which is a very desirable feature for domestic use, and consequently some air must be supplied to keep up what is being carried off. When the water has a pressure of 50 pounds or more upon it in the tank, it shows a somewhat milky appearance when drawn off, on account of the air all through it, but the air globules quickly rise, and the water becomes clear.



Compressed Air Water Works.

The illustration shows a 75-barrel tank with all the apparatus complete, the power in this case being received by the pulley on the cross shaft above. The bevel gears reduce the speed about three to one, and the crank on the end of the longitudinal shaft works the pumps by means of a yoked connecting rod attaching to a crosshead which operates both pistons. The upper pump is for air, and the lower one for water. An automatic device, not shown upon the apparatus illustrated, is provided for throwing off the power when the tank is full, especially if a wind mill is employed. It is proposed to use this apparatus for hydraulic lifts and similar service, in which case the same water may be pumped and used over again. The tanks and pumps are made of any desired capacity and to suit any circumstances, by E. Neff & Co., Milford, Indiana.

The Right of a Railroad to Scald an Employe.

A lawsuit of some interest to mechanics has run its course in Massachusetts. The plaintiff in the case, William A. Perry, was in the employ of the Old Colony Railroad Company, and was sent by a foreman to do some repairs to an engine standing in the roundhouse—grinding a check valve seems to have been the job. While the man was working in the pit the engineer opened the blow-off cock and Perry was badly scalded. The injured man brought suit against the company for damages, and upon the trial the jury found that the foreman was negligent in sending him under the engine without providing against such an injury, and that the engineer then in control of the engine was negligent in blowing off the engine while the plaintiff was working under it, and they awarded the plaintiff $3,000.

Of course the case had to be carried up, and now the Supreme Court of Massachusetts, by a majority opinion, has sustained an exception taken by the defendant and sets aside the verdict. The court holds that the Employers' Liability Act does not contemplate that a railroad company shall be liable to its employes for injury sustained from a locomotive stalled in a roundhouse undergoing repairs. Upon the claim that the foreman was negligent the Court says, from the evidence it appears that the engineer and the fireman of the locomotive knew that some one would be sent by the foreman to do the repair, and it hardly would seem necessary for the foreman to notify them that he had done what in the ordinary course of things they had every reason to expect he would do. It did not appear that there was anything unusual about the job, or in the manner or place of doing it. The place was dangerous but the plaintiff knew it. He knew that the engine would have to be blown down when the check was ground in, and that it was done as commonly over the pit as anywhere, and so there was no negligence on the part of the foreman in failing to notify the plaintiff of what he well understood himself. In respect to the negligence of the engineer who was in control of the engine, the Court says nothing as to whether he was negligent or not, but that he did not have charge of or control a locomotive upon a railroad track within the meaning of the act.

To us the verdict of the jury looks like common sense and common justice, but the decision of the Supreme Court of the Commonwealth of Massachusetts is Law.

Doings at Backaway.

Mr. Editor—You will remember that some time ago I wrote you something about the peculiarities of Johnson; amongst other things, how he pulled out from the place where he mined the engine out of grease, the accumulation of years, and how he patched up the old shackly engine that he found under the grease and dirt, put cheap pictures over holes in the walls of the engine room, and when he had things fixed up the

best he could, quit from the word, because the proprietor wouldn't have a new sheet put in in place of one in the boiler dangerously cracked. Quit, and the next day went to the new mill under the hill—the Richmond. Johnson stayed there till the big mills—the Oceanic—were put up at Backaway, within a stone's throw of the G. & I. They made Johnson a flattering offer, one the Richmond would not meet, so he accepted.

The Richmond people showed that trait that comes to the front in men whose jealousy and selfishness are abnormally developed. They tried to persuade the Oceanic people not to employ Johnson. Hiring other men's employes, demoralizing the labor market, and so along through the list of stock ideas that you and I, Mr. Editor, have often heard. It was time expended to no purpose. Johnson went to work at the Oceanic just the same. Johnson's business was to run the big engine and have an oversight over the engineer who run the electric light engines, pumps, etc.

One day, after Johnson had been at work about three months, the old man came into the engine room (he was a trifle eccentric in speech, but every one said a good man); he came in and looking at the engines remarked: "Runs about as slick as grease, don't she, Johnson?"

Johnson admitted that it was his intention to have her turn over without shaking the foundation of the mill.

The old man went through the boiler room, pump room, looked at the electric light engine, then coming back, said: "Johnson, I don't believe there is a man in the world that don't like to be praised. Just come through the boiler room and I praised Tom's firing—it deserved it. Well, now, would you believe it, Tom's face brightened right up through the soot and dirt, as he replied: 'Hope to do better in a week or two when I get the hang of things a little more.'

"But, after all, Johnson, what made me think of this was a letter I had this morning from Herndon & Co. Wrote me a letter voluntarily, saying that the last bill of goods we sent them was the best they ever had from any mill in quality and workmanship. Now, when I send them more goods I shall take care that they are as good. I thought I was getting over those things. A man may think he has drawn himself so far into his shell that he can't be reached, but it isn't true, not if he is a real man."

The old man took another turn around the engines, then went abruptly up to Johnson and said: "Johnson, I don't want you here any longer."

Johnson was a little surprised at the old man's abruptness, well as he knew his ways, but he replied promptly: "All right," a little flushed, though he doesn't get rattled easily, "I'm ready to quit just now—can be off your premises in five minutes."

The old man was nettled. "Who in thunder," said he, "has said anything about quitting, getting off the premises, and the like? I did say I didn't want you here—in this room—any longer, and if you had heard me out I was going on to say that we would fit up an office room for you, and you should have general charge of all the machinery in the mill—be master mechanic, you know.

"You see, Johnson," continued the old man who had got smoothed out, "I'm just rushing to the forge for a new shaft, to the foundry for castings, ordering supplies for the mill and doing lots of other things, and I've got tired of it—got too old for all this; besides, I want to go fishing. When we were in the old mill I used to think no one else could do it; now I think I can't do it. Someone else has got to, or we'll shut up shop. To do this work and have an oversight over the engines and machinery is what I want a master mechanic for. I've been a blamed old fool to harness myself down, when old, in the way I have, but now I'm going to kick right over the traces, and I want you to help me kick."

Johnson, as has been intimated, was pretty well acquainted with the old man's characteristics, one of which was his determination to do a thing he had set his mind upon. There was no trouble in making arrangements as between Johnson and the old man, the latter stipulating that he wasn't to be bothered in any way about the machinery and supplies. "There are," he went on, "about a dozen cousins in some degree about the mills, and they all want to order something. You'll have to break that up so far as your department goes; give them more time to attend to their regular duties. I'll make an order to the effect that you do all ordering, and you see that it is carried out. I tell you, Johnson, when a man pulls right down to his regular business there isn't much loose time about him."

This was the way Johnson came in charge of the mechanical department of the Oceanic, about as large as any two others in Backaway, or in the country, as to that. This Johnson that not long before was patching up a rickety old engine in a tumbledown engine room, *making the best out of the things that were.*

Joel Oldone.

LETTERS FROM PRACTICAL MEN.

A Greasy Swindle.

Editor American Machinist:

I frequently receive through the mail a circular letter offering to sell me a superior article of oil at a very low price, and always for some special reason indicating a sacrifice or "bargain." This letter looks like a written letter, but if I turn it over the back shows that the body of it is printed and the address and "Dear Sir" put in with a typewriter. To make it more enticing, it is generally accompanied by an addressed envelope with stamp, for reply.

I suppose that many machinists and users of oils get this same letter as regularly as I do. It is not always from the same concern, but always from some place a great ways off.

I fell into the trap the first time it was put in my path, but did not get badly hurt. That time it was a fine "lard oil," offered at 29 cents per gallon, which I knew very well was worth nearly double the price. I sent for it, and, although I am no oil man, I knew it was no lard oil. To test it (and the letters always invite a close examination as to quality), I sent samples to several Boston oil dealers asking each one what it was and what it was worth. The replies were uniform that it was worth from nine to twelve cents per gallon. Two replied that the material was "dregs of paraffine."

The best way to buy oil is to pay what it is worth. You cannot get good machine oil at less than forty cents, or good cylinder oil at less than sixty cents.

George B. Grant.

Methods of Governmental Manufacture.

Editor American Machinist:

I have been thinking quite a little while about the weight of those guns that were made at the Watervliet Arsenal. The statement was, I believe, that seven 12-inch guns, weighing 115,000 pounds each, varied from each other only five pounds in weight, and a credulous engineering journal accepted the figures and went on and argued from them the perfection and accuracy of the methods of their manufacture. One of these guns being 12-inch bore, 40 feet long, and assuming a mean external diameter of 24 inches, of course, as the American Machinist has shown if I may be allowed to differ a little in the figuring, an inaccuracy of .001 inch all around the bore, or a half of that outside, or one-sixteenth of an inch in length, would account for the difference in weight, or, as a correspondent suggested, if all the dimensions of all the guns were absolutely identical the difference in specific gravity in the material employed could easily have caused, and probably would have caused, a greater difference than five pounds. I do not believe the yarn at all, and if it were true it would prove nothing. The Baldwin Locomotive Works might as well advertise that a half a dozen of their locomotives of the same pattern will not vary more than five pounds in weight, just to show what fine work they do at that establishment. Probably the guns were not weighed at all and their weights were computed, and the five pounds of difference arose from the difference in methods of computation or in the number of decimals carried. It is not necessary to tell anyone that the work on those guns is of wonderful accuracy. I do not doubt it in the least. I think it very likely that it is just as careful and accurate in the non-essentials as in the essentials, and that is what the weight story would tend to prove if it proved anything. I suppose that none of the men, certainly none in authority, are in the Watervliet Arsenal in 1895 who were there in 1862, but it is quite likely that some of the methods of management and inspection that then prevailed still survive there. It happened that in the early part of the war the arsenal was making a great many bits for cavalry and artillery horses, and, of course, were pushing all their facilities to the utmost. The sides of the bits were drop forged and then they were filed all over by hand. Men at the arsenal filed about two and a half of the sides in a day, and if they ever filed three they were in danger of being discharged as it would be said that they were slighting their work. At the same time a great many of those bits were being made by parties outside of the arsenal by contract and inspected upon delivery. Men working upon the bits in the outside shops were filing as many as twenty-five a day, while the men in the arsenal were filing two and a half. Are our guns made as cheaply or any better than they could be made by contract?

Tecumseh Swift.

Mechanical Notes—Blowing Off—Leak Hole in Pump Piston—Standard Threads—Pipe Joints.

Editor American Machinist:

When a boiler is blown off under pressure in the manner stated by Mr. Wakeman the pressure remains practically constant for two reasons: 1st. Because the weight of steam in the steam space is comparatively small, and when this space is, say, doubled, enough steam is generated from the hot water to fill the double space without necessitating any serious drop of pressure to set the steam free. 2d. When we foolishly blow out a boiler under pressure there is usually sufficient heat in the surrounding brickwork to produce the steam to fill the increasing steam space without the pressure falling, and when such is the case we may realize the risk we run by the practice.

Reference is also made to the leak hole in a pump piston. A similar leak hole was employed some years ago on the pistons of the vacuum brake by one of the principal railways on this side, and it enabled the brakes to leak off in a few minutes.

The leak hole did not form a part of the vacuum brake idea, but was an addition made by the railway people, and if my recollection is correct an accident was once due to the leak off and was laid to the debit of the brake instead of to the fault of the people who drilled the holes. A leak hole is rather a step out of correct mechanical straightforwardness, and speaking generally such things are better avoided even at the cost of more expensive means.

The railway man's idea of the leak was doubtless to allow brakes to leak off disconnected vehicles, whereas a special by-pass with closing valve should have been provided; but a leak hole is out of control; it compares with water-tight doors on a ship. The latest practice in water-tight compartments avoids the necessity of closing doors after a collision, for there are no doors to close, and access from one compartment to another is only to be gained by an ascent and descent.

Why cannot all English-speaking people agree upon a standard for screw threads, and, why, having a standard, cannot people stick to it? Here we are supposed to use the Whitworth thread for bolts, and the Whitworth gas thread for pipes, but one maker's pipes will not by any means interchange with those of other makers, and, what is worse, while 11 threads per inch is standard for all threads above the smaller sizes of pipe there is one certain class of pipe by a certain maker which has for no reason that I can fathom 12 threads per inch. Then, again, in steam and gas pipes what is the taper allowed? I cannot learn that there is any particular rate of taper, but so far as I have measured samples there appears to be an eighth of an inch in the diameter allowed for all sizes, the taper being to assist in making a good joint. Ordinary wrought-iron pipes do not make a butt joint inside their sockets. The joint is made by the tightening up of a taper-threaded portion. In these days of accurate tools it seems that all pipe ends should be trued off and that the joint should be made by butting the pipes together, a thin joint ring being used when desired. Such pipes can be made as they are indeed now made for well lining and drive wells, or they could not be driven as they are.

It ought to be made a criminal offense to depart from standards.

W. H. Booth.

London, Eng.

Lathe Centers—Power Test of Lathe—Jarno Taper.

Editor American Machinist:

Two or three articles appearing in recent issues of the American Machinist, upon the subject of lathe centers, have brought to mind some things that have come within my experiences.

Some six or seven years ago I went with a gentleman to visit a large railroad machine shop. My friend was trying to introduce a center grinder of his make into shops in that section. We were sent from the office to the foreman of the machine shop. That shop and foreman reminded me of an antiquated government navy yard, where the men held their positions as long as they maintained the necessary "pull." Many of the tools were out of date, and certainly the foreman was. He said that he thought soft lathe centers were preferable to those that were hardened and ground, as the soft ones could be turned with a lathe tool and finished with a file.

It is needless to say that no sale was made there, and the foreman was left with his centers and "head piece" to match.

Who, that has seen soft centers used continually, has not seen them bent out of shape by the pressure of the tool?

A shop that is to do first-class work at a reasonable price must adopt a standard angle for lathe centers, have all the lathe centers kept to this standard, and have the center holes in the arbors and work made to fit these standard centers.

To make soft centers fill and maintain this requirement is next to an impossibility.

What the standard angle shall be is a question that interests all, and the adoption of any angle by one concern in a measure affects others, as machines built in one shop go to many different places for repairs.

As you say in your article in the issue of June 6th, the angle of 60 degrees has been quite generally adopted for lathes below 6 inches swing, but for larger lathes various angles have been chosen from 60 to 90 degrees.

In the issue of August 15th, Mr. E. A. Muller says he has found by experience that 60 degrees for large work is just as good as 90 degrees, and I am not surprised at his finding.

About two years ago, while with the Shaw Electric Crane Co., I spent some time in making a series of tests to determine the power required to drive machine tools. One of the machines tested was a 42-inch lathe. This lathe was used to turn the hoisting drums for cranes, and special centers had been made for this purpose, and the center holes in the arbors were, of course, fitted to them.

The angle of these centers was 40 degrees, and the results obtained were all that could be asked.

It may be interesting to digress a little and describe the test to which reference is made.

An electric motor was belted to the countershaft so as to give the same conditions as when driving the lathe from the main line

shafting. The drum was good cast-iron, 39 inches in diameter, about 10 feet long, and weighed 5,200 pounds rough.

From about fifty readings, the following is taken as a fairly representative condition:

The tool was cutting scale. Drum was reduced from 39¼ inches rough diameter to 38½ inches. Cutting speed, 19 feet per minute. Feed was .075 inch per revolution. 1.22 pounds of stock were removed per minute, requiring 1.87 horse-power to drive lathe. Energy required to remove one pound of metal per minute was 1.53 horse-power. This is the power given out by the motor, and not the electrical energy received by it.

From a test to determine the efficiency of the belts and gears of this same lathe, it was found that the efficiency varied from 0 to 65 per cent. when running with belt on slowest step of cone, and driving the spindle by the face-plate gear, it being a triple-geared lathe.

Under the conditions of the above cut the efficiency was about 59 per cent., which would give 1,962 pounds as the pressure on the cutting tool.

This cut was not very heavy for a lathe of this size, but was all that was required to reduce the casting to size. The greatest strain, however, was upon the bed, due to such a heavy casting, so long a distance, about 10 feet, between the lathe centers, and to the fact that the head and tail stocks were raised about 4 inches in order to swing the drum over the carriage.

As before stated, the angle of the centers was 40 degrees, and the centers in the arbor were deep enough to give sufficient strength and area of bearing surface. This angle made a very much less strain upon the bed than would have been produced by centers having an angle of either 60 or 90 degrees.

The centers were lubricated with graphite and oil, and certainly no one could ask for better results than were obtained with these centers.

Inasmuch as the angle of 60 degrees for centers has practically become the standard, I would not recommend a change, although I believe a smaller angle would be better, if properly used.

Lathe centers should be hardened and ground to the standard angle, and the centers in the arbors and pieces to be turned should be deep enough to give strength and bearing surface.

In connection with the angle of lathe centers, the "Jarno taper" was mentioned in the article to which allusion has been made.

I wish again in these columns to add my feeble efforts in favor of the adoption of the "Jarno taper" as a standard to be used for lathe centers, gear cutter and milling machine arbors, twist drills, and wherever shanks are used that are now made with a taper of ½ to ¾ inch per foot.

There is no place where it can be said that ½ inch or ¾ inch would be superior to $\frac{6}{10}$ inch per foot, which is the Jarno taper.

With this system it is only to know the number of the shank to know all its dimensions. It is the only method of making and designating tapers which can be called a system.

The Brown & Sharpe Mfg. Co. adopted and use ½ inch per foot taper, but no one can tell the dimensions of a given size or number without a detail drawing. The Morse taper is well known by name, but each size has a different taper, and varies from $\frac{6}{10}$ to $\frac{8}{8}$ inch per foot, which also shows no system in the matter.

Several years ago I designed a machine for grinding chilled wheels. These wheels were placed upon an arbor the same as are gears for cutting in a gear cutter. There was also in the shop a 70-inch gear cutter to be furnished with arbors, and I decided to use the "Jarno taper" for both machines.

Five arbors were made, one end of each being fitted to the machine, and the other turned to one of the five tapers, Nos. 8, 10, 15, 20 and 28. Split bushings of cast-iron were made to fit these tapers, and every size hole in gears and wheels, from 1¼ to 7 inches diameter, could be fitted with these five arbors. With little expense odd sizes of holes could be fitted when necessary.

Taper arbors were made for the lathes of these same sizes, and work was turned upon split bushes with excellent results.

If holes are standard size, as they should be, and the bushings only .001 or .002 inch under size and made with six splits, three from each end, no trouble will arise from the outside of the work not being turned concentric with the hole.

Very heavy cuts can be taken with these arbors, and they are much more easily removed from the work than is a solid arbor tapering only .01 or .02 inch per foot.

If a few manufacturers of such tools would place standard reamers upon the market of the "Jarno taper" I believe it would be much more quickly adopted.

When, however, a concern has to stop, as was done in fitting up these machines with arbors, to make a set of expensive reamers, they are apt to take anything that they can find in the market, although they know it to be an inferior article.

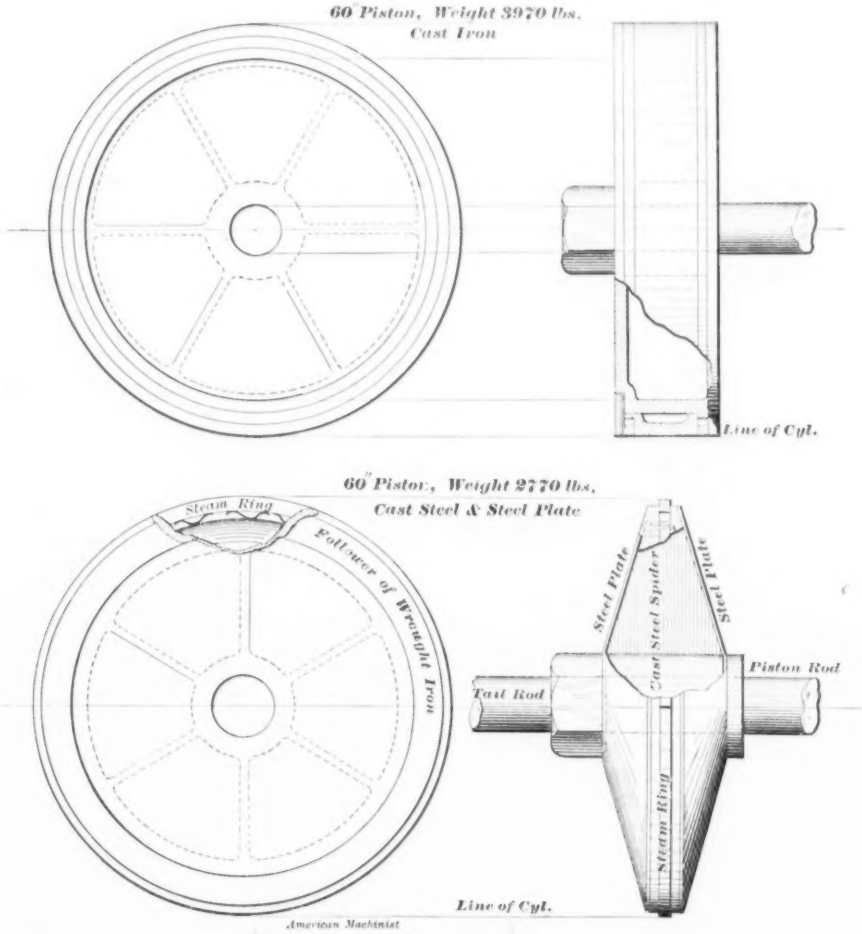
It, however, pays in the long run to do the right thing the first time.

Dan. C. Woodward.

Piston Construction—What it is and What it Ought to be in Modern Horizontal Engines.

Editor American Machinist:

The accompanying sketches are intended to illustrate approximately this subject; taking the first one as the representative piston of to-day, we have a cast-iron disk of about 60 inches diameter by 15 inches in thickness, now assuming that it is made as light as possible of this design it will still weigh 3,970 pounds, now the result of moving this mass of metal along the bottom of a cylinder at a piston speed of 800 feet per minute, can only be appreciated by those who are responsible for its care; not only stationary but marine engineers are interested in this subject, as surface condensers coming into general use both on land and water confronts the engineer with the problem, is it better to lubricate the pistons thoroughly and burn the boilers, or let the cylinders cut, and save the boilers, or raise a howl, and have the pistons made to suit the present conditions? This I think is the better way out of the present trouble, and the engine builders are the responsible parties, but naturally they will not increase the cost of their engines, unless compelled to recognize the defects and the result of them, as experienced every day by thinking engineers all over the country. The sketch showing steel piston 60 inches diameter, I think would get us a long way out of the trouble, as it can be made lighter and stronger to the extent of 33 per cent., which would permit us to suspend it entirely on piston rod clear of the cylinder entirely, except steam ring; by making the rod somewhat larger, and using solid collar and nut of large area, we would overcome the deflection to a great extent, if not entirely. Crank end of rod could be adjusted vertically in the usual way, while a similar but lighter slipper could be applied to slide at head end of cylinder, we would thus have the lubricating all to be done externally, which is the proper place to do it. Now let us see what this would cost, and the results in many cases in an engine of 2,000 horse-power, the advance would be for low-pressure cylinder 1.8 per cent. on first cost, and the saving per year in water alone, which in most cases is thrown away on account of the large amount of oil it contains, would be $423, if using water from city mains; also the oil dispensed with, as we would then lubricate the piston supports with machine oil in the proper place, dispensing with cylinder oil almost entirely; we would do our lining up of piston on the outside, and have to open a cylinder very rarely, as steam packing is never troublesome, and the wear in this case would not be appreciable. As the only way to reform engine construction is to create a demand for it. I hope that these few suggestions will bring to the notice of engine users and engineers the possibility of making the extended piston rod popular in this country, in the larger class of engines, with pistons designed so as to make it fully effective.



Piston Construction.

Engineman.

An Authority on Heating Steel.

Editor American Machinist:

Mr. Simonds' views and practice are entirely correct, and that kind of teaching will have to be continued as long as new generations of men grow up and require to be taught.

"Cherry red" is a ridiculous expression, against which I have protested for years, for the reason that the heat colors run in the orange series, and not in the red.

For experimental purposes the pirometer is of great use to obtain exact data, but as it cannot be used in everyday practice by every temperer, the educated eye should be insisted upon as the best measurer of temperature, and that eye should be drilled to make nice distinctions in orange and lemon tints, and in getting those tints uniform in each individual case. A properly heated piece of steel will look as if it had been dipped into a pot of well mixed paint.

Wm. Metcalf.

Pittsburg, Pa.

The Heaviest Drop Hammer.

Editor American Machinist:

Referring to the matter of heavy drop hammers, that having been the subject of several letters in your recent issues, we would say that we have made quite a number of drop presses, with hammers weighing 1,875 pounds, and have made three with hammers weighing 2,500 pounds. One of the latter size has been in constant use for over 20 years. We list in our catalog and have drawings and specifications for a drop hammer with a hammer of 5,000 pounds.

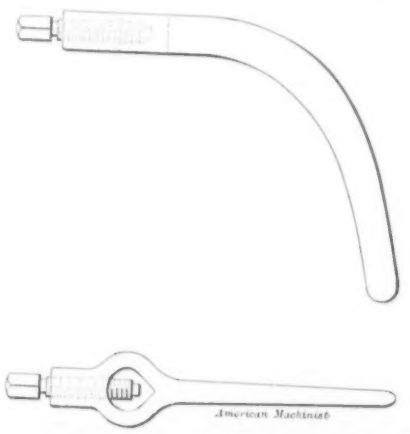
Miner & Peck Mfg. Co.

New Haven, Conn.

Dog Wanted.

Editor American Machinist:

Enclosed please find sketch of a form of lathe dog, which we have had in use for some time but cannot duplicate. We do not find this dog illustrated in any of the catalogs that have come to hand, and would ask if you can put us in communication with the makers. If not, perhaps you would be willing to ask, through the columns of your widely circulated paper, for information in reference to same.



Brown & Sharpe Mfg. Co.,
Per D. D. Donovan.

Patent-Office Practice.

Editor American Machinist:

I was much interested in the novel steam engine recently patented, and described in the American Machinist, September 5th. I took pains to go over it until I think I fully understand the operation of the valve, and the arrangement of the parts, and there is certainly a great amount of ingenuity displayed in the design for the accomplishment of the inventor's avowed purpose, and to me it is marvelous that so much ingenuity could be combined with so much ignorance of the practical operation of steam in the steam engine. It seemed to me at the time that the remarks on patent-office practice that were given in connection with the description were all right. Many persons of considerable intelligence have at different times expressed some doubts about some of the details of patent-office practice, but it seems that they have all been mistaken. Mr. R. D. O. Smith, in the American Machinist, September 26, says that our patent laws comprise not only the corner stone, but the greater part of the foundation of our national prosperity. If the greater part of the foundation were knocked out, of course, the structure would fall, so it behooves us to deal with it carefully. If Mr. Smith does not argue that everything pertaining to our patent system at present is absolutely right, he does at least argue that the features of the system which permit the issue of worthless patents are right. The fiction that a patent is granted for a novel and useful invention, he shows is only a fiction, and not carried out in practice, and that patents are granted for anything that has any feature of novelty, and that is not absolutely dangerous or harmful. As this is Supreme Court law it is not for common mortals to find fault with it, but it is certainly rather lamentable that the status of patents and patentees, in the estimation of the general public, is not higher than it is. A patentee is regarded as a harmless imbecile, and a patent is considered to be something that will swallow all the money that may come near it, and still cry for more. It is to be regretted that if the patent laws were to be defended they could not have found a better advocate than one who never saw a credulous capitalist, and who knows nothing about the "no patent no pay" patent agent.

Tecumseh Swift.

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The Manufacturers' Club of Philadelphia and Its Organ.

The Manufacturer is the name of a paper published in Philadelphia. Its sub-heading declares that it is "a journal of American interests," and it is announced that it is "published weekly by the Manufacturers' Club of Philadelphia." The natural inference from all this would be that *The Manufacturer* must reflect the views of the club, or at least of a majority of its members, and that it says about what they think should be said on all subjects. That the journal is so regarded, outside of Philadelphia at least, is shown by the quotations from and references to its columns that appear from time to time in New York and other newspapers.

But after watching the course of this journal for some time, we had concluded that it could not possibly represent the views of Philadelphia manufacturers generally, nor even of the club members, and, having some acquaintance among those of them who are interested in machinery, we took occasion, during a recent visit to the city, to ascertain what a number of club members and others thought of the matter.

We did not find one that indorsed the course of *The Manufacturer;* on the contrary, every one with whom we talked about the matter disavowed with more or less emphasis all responsibility for or concordance with the opinions expressed by the club organ.

Although ostensibly published under the direction of "The Publication Committee," it is generally understood that this remarkable club organ is really edited by Mr. Charles Heber Clark, who made himself prominent as an advocate of free silver coinage at the Cincinnati meeting of the Manufacturers' Association last January. At that time he distinctly stated that he represented no one but himself when talking on the silver question, and we have nothing against him on account of any views he may or may not hold on any subject whatever, but we are confident that he is doing the manufacturers of Philadelphia an injury by being allowed to apparently speak for them when indulging in scurrilous personal abuse of the President of the United States, in dire predictions and calamity howls about what is going to happen if his own views are not adopted and carried out, and, in short, carrying on the paper as though it were one of the less dignified and least self-respecting political, or, rather, politico-factional, organs, instead of a paper representing an association of men with like business interests, but of all shades of opinion regarding political parties and party measures.

Having talked with a number of Philadelphia manufacturers (interested in machinery), we can say that, as we expected, they concede the right of an American citizen to have his own opinions regarding political matters, and to stand up for those opinions in every proper way and on every proper occasion. They recognize that men can differ in opinion on such matters and still be perfectly honest and patriotic.

They may differ as to whether the President of the United States is really "the incarnation of stubbornness and stupidity," but they are unanimous in declaring that the official organ of a manufacturers' club injures that club and its members by using such language regarding the regularly constituted official head of our government.

They unanimously condemn scurrilous remarks about the South and about New York City. They all think that the obligation of President Cleveland to the ex-Queen of Hawaii is something that has little or nothing to do with manufacturing interests, and that the club as such should express no opinion regarding this subject, and they object to frothing at the mouth and calamity howling generally because silver is not coined free, and because the opinions of bankers and other students of financial affairs receive some consideration in official circles and in Congress.

All this being true, the question naturally arises, Why does the club allow this sort of publication to continue? And the answer, so far as we can give it, is simply that no one has made it his business to call attention to the matter and take steps to prevent it. It was stated to our representative that it was pretty well understood in Philadelphia that the paper reflected the views of two members of the club only—one of these being Mr. Clark, and the effect the paper might have in other sections of the country was overlooked.

We take it upon ourselves therefore (with the approval of some of those concerned) to say that, so far as the machinery builders of Philadelphia are concerned, they are not all narrowminded bigots, incapable of seeing that a man may honestly differ from them in opinion, and that they do not believe that those outside of their particular political party, or their particular faction of a party, should be abused and vilified for exercising the rights of American citizenship. It ought not to be necessary to say this for them, but certainly the opposite conclusion would be arrived at if one had no other testimony than that of *The Manufacturer*.

An Oil Swindle.

Elsewhere in this issue, Mr. Geo. B. Grant calls attention to what he names a "greasy swindle." With his letter he inclosed for our inspection a sample letter from a concern in Cleveland, and we have tried to get sufficient definite facts regarding this concern to warrant us in giving its name as a swindler, but have thus far failed to do so.

It seems certain, however, that persons in Cleveland are working this game, the usual pretense being that for some reason they already have the oil (always a small quantity) in a warehouse near the prospective victim. The evident object of this is to convey the impression that the oil is there by some mischance, and that it is therefore offered far below its regular price rather than pay transportation charges back to headquarters. The fact that the body of the letter is printed in imitation of typewriter work, shows that many such letters are sent out, and that it is therefore on its face a swindle.

It is, of course, only another illustration of the familiar fact that extra caution must be used when a thing is offered for nothing, or below its regular price; but such offers come in so many different forms that one must keep one's eyes always open or be defrauded.

The Mechanic and the Farmer.

It is not to be wondered at that the average mechanic and the average farmer do not understand each other's methods and conditions, and in consequence do not appreciate each other as they should. In everything in life the circumstances of each seem to be almost the antipodes of the other. The mechanic is accustomed to see the intimate relations of cause and effects, of means and ends, of effort and accomplishment. Mechanics deal with things that are exact and certain. The farmer is certain about nothing, except perhaps long averages. Agriculture is a lottery if there ever was one. The seed planted may be reasonably expected to yield in kind, but none may say what will be the quantity of it or its actual quality. After the farmer has done his best, the soil and the sun, the wind and the rain, frost, snow, hail, lightning, blight, predatory insects must determine what his crop shall be. With a farm of a given acreage, the annual expense of plowing, planting, cultivating, harvesting, threshing, is practically a fixed charge. A mechanic with his expenses all determined would expect to figure very closely his product and his profit. It is notoriously otherwise with the farmer. The most promising conditions for a summer may be nullified before the harvest. The farmer is also at the mercy of circumstances in the sale of his products. Market prices play up and down daily, values rise and fall, and not until the cash is in his pocket has he the true measure of his crop. A difference of one cent per bushel is said to mean $4,500,000 to the farmers of the United States. In August, 1894, wheat sold for 57 cents; in August, 1895, it was 75 cents; as we write it seems to be considerably lower, still this is a year of great prosperity for the farmer, and no one should rejoice over it more than the mechanic. The farmers will be buying clothing and equipments, they will be repairing and building, they will be taking rides on the railroads and stirring things up all around. Good crops and fair prices for the farmer mean good crops and living wages for the mechanic also.

Theoretical and Practical.

The meaning and value of these terms are by no means so determined and fixed as some would have us believe, and they will bear a re-weighing and a readjusting occasionally. The honors at present seem in the popular mind to rest upon the practical rather than upon the theoretical side. Many a man is ready to claim for himself that he is exclusively a practical man, while few could be found in the world who would claim, or even readily admit, that they were only theorists. Some college professors might be ready to make the claim, but they are becoming rarer, and will soon be extinct. The term practical has been much overworked, and the "practical" man often usurps honors to which he rightly has but little claim. A man may know nothing about a boiler but to shovel in the coal and to see that the water is kept at a proper level, or about the engine he may only know enough to open or close the throttle, to bar over the center and pour on the oil, yet he is the practical man, and is proud of it; and there are many who are ready to pat him on the back. Men of this caliber are continually showing that they are not practical men by doing the most unpractical things whenever anything occurs to be done beyond the daily routine. The practical man too often does not know anything of the relations of cause and effects, or the reasons why things are so, or why for the accomplishment of certain ends certain conditions must be fulfilled; yet what could be more pre-eminently practical than such knowledge, or what does it lack of being also entitled to be called theory? The practical man when he fails, as he too often does, must trace his failure to lack of theory, or to insufficient knowledge of things and their relations. When the practical man is required to be most practical, or to be most successful and reliable in accomplishment, then is he also best prepared by being most theoretical, or most fully advised as to the facts involved and the correct interpretation of their relations. The theoretical man, the book man, or the school man, whenever he shows his inability in practical or successful accomplishment, too often fails for the same cause that brings the practical man to grief—a lack of theory. The best of theorists seldom gets a theory complete, some facts or some deductions still are missing, and it is for lack of these that he cannot be called practical, though actually more completely equipped than the one who wins success. "A little knowledge is a dangerous thing," perhaps. It certainly is often the unsuccessful or the unpractical thing. So, too, is much knowledge also unpractical, but the trouble with both is still the same—the lack of a little more knowledge.

Our bright and prosperous contemporary, *Locomotive Engineering*, announces two additions to its editorial force. Mr. Orville H. Reynolds leaves a position as mechanical engineer of the Northern Pacific Railroad to connect himself with the paper. Mr. Reynolds has contributed to our columns, and his selection for his new position is undoubtedly an excellent one.

Mr. F. M. Nellis assumes charge of the Air Brake Department; and, as it has been and still is his business to instruct railroad men in air brake matters, the wisdom of his selection is apparent.

The Bureau of Yards and Docks, Navy Department, has invited proposals for the construction of a centrifugal pumping plant for the granite dry dock at the New York Navy Yard.

Only one bid was received at the Navy Department for the construction of Lee rifles, and the contract was awarded to the single bidder, the Winchester Repeating Arms Co., at $17.50 per gun.

Literary Notes.

A MANUAL OF MARINE ENGINEERING, comprising the Designing, Construction and Working of Marine Machinery. By A. E. Seaton, lecturer on marine engineering to the Royal Naval College, Greenwich, member of the Institution of Civil Engineers, member of the Council of the Institution of Naval Architects, member of the Institution of Mechanical Engineers, etc. Twelfth edition, revised throughout and enlarged.

The progress in marine engineering practice has been so great since this book first appeared, that in order to bring it up to date much had to be re-written and considerable new matter added; in regard to this the author states in his preface that, "Most of these changes in engineering practice were gradually introduced, so that it was not difficult, by slight emendations and additions, to bring the book up to date at the issue of each new edition; but other changes have been more rapid, so that, in the present edition, the author has felt it necessary to cut out much that is now only of historical interest, and to add new matter dealing with the changed condition of affairs. Further, no inconsiderable portion of the book has had to be re-written for the same purpose. An entire new chapter on the water tube boiler has been added, as the author believes that the present is an opportune time for dealing with this important subject, since that which hitherto had been rather matter for experiment, has now become an assured success for the purpose required."

Engineers, draftsmen and students will find this work to be an exceedingly valuable one; it treats on the application of theoretical principles to the design and construction of marine machinery, based on data collected during years of study and from recent successful practice. The rules and formulæ are given in the simplest form attainable, and may be used by any one who designs with some regard to theory. We know of no other work which contains as much reliable information on marine engineering as this one, and it can be accepted as high authority on this subject. Many of the principles are also applicable to the design and construction of stationary engines, and by varying the constants in some of the formulæ may be made to suit the ideas of strength and stiffness of the stationary engine designer, particularly when he has to deal with designs of multiple-expansion engines.

It is published by D. Van Nostrand Company, 23 Murray and 27 Warren street, New York. Price, $6.00.

Questions and Answers.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet. We cannot undertake to answer questions in "next issue." This department is usually crowded, and questions must wait their turn to be answered. Neither can we undertake to solve mechanical or engineering problems, and send answers by mail.

(365) S. J. H. K., Reading, Pa., asks: Is there any liquid solution in which machine steel can be case-hardened? *A.*—We know of no quenching solution which will case-harden machine steel, but if machine steel be heated in any way and then dipped in melted cyanide of potassium, and then quenched in water, it will case-harden. Small articles can be heated direct in the bath of melted cyanide.

(366) J. L. A., Chicago, Ill., writes: With radius and angle given, what is the simplest method of computing the sine of an angle? *A.*—You cannot compute this without the aid of a table of natural sines. Look in the table for the given angle and take out the corresponding sine, multiply this by the given radius; the result will be the length of a side opposite the given angle of a right-angled triangle whose hypothenuse is equal to the given radius.

(367) W. B. H., Fostoria, Ohio, writes: Please inform me how to cast the lower die, made of soft metal, used in the common seal press. *A.*—The metal, often type metal, is heated and poured in a plain cast-iron form or box not much larger than the required size of the die, the metal is allowed to cool, and just when it is about to solidify, the upper die, fastened to the under side of a weight, is allowed to drop on the metal. The hight through which the upper die must drop and the amount of weight upon it can only be determined by experience. In dropping, the die and weight must be guided by suitable means. Sometimes, in place of dropping, pressure is applied so as to obtain a good, clear impression.

(368) S. D. S., Baltimore, Md., writes: Please give me your opinion in regard to a set of books relating to the machinist trade and engineering. There is a set of books called the "Encyclopædia Britannica," which I can get for $81. Please advise me if there is a better book suitable for a chief engineer, which I could get for the same money. Or do you know of any books with which I could get along all right in the two branches referred to, and get these books for less money? *A.*—The encyclopædia to which you refer is an excellent work, it treats not only on engineering and kindred subjects, but it also treats on many subjects outside of engineering, which may not be of interest to you. Although this work is a valuable one, and covers a wide range of subjects it cannot be said that it is specially written for the engineering profession. We should advise you to examine it before you buy. It is difficult to recommend books to strangers, and more so, when we do not know how far they have advanced in their studies. In answer to Question 539 in our issue of November 22, 1894, we have indicated a course of home study for machinists and engineers, accompanied by a list of suitable books, from which you may select books treating on such subjects with which you may not be as familiar as engineers should be.

(369) C. H., Brooklyn, N. Y., asks: What per cent. of heat units in coal is transferred to the steam in the best type of modern steam boilers? I merely wish to know approximately what results have been secured in the best modern practice. *A.*—In a good constructed boiler a pound of coal should evaporate 10 pounds of water from and at 212 degrees Fahr. To evaporate one pound of water under these conditions requires 966 units of heat, hence for 10 pounds of water 9,660 units of heat will be required. The units of heat in one pound of coal we may average at 14,000, hence the per cent. of units of heat in coal transferred to the steam is about 69 per cent. Of course this must be taken as an approximation, as much depends on the quality of coal used. 2. What per cent. of heat units of the steam in the boiler is converted into work in a high-pressure engine, condensing engine, compound and triple-expansion engine? *A.*—The consumption of a good quality of coal per indicated horse-power per hour with a good triple-expansion engine may be taken at 1½ pounds. Now, assuming again that each pound of coal when completely burnt gives out 14,000 units of heat, then for 1½ pounds of coal 21,000 units of heat will be given out per hour, or 350 units of heat per minute. Assuming that each unit of heat is equivalent to 772 foot-pounds of work, then 350 units of heat should be equivalent to $350 \times 772 = 270{,}200$ foot-pounds of work per minute. But the 1½ pounds of coal, when a triple-expansion engine is used, give us one horse-power only, or 33,000 foot-pounds of work per minute, hence of the total heat of combustion only

$$\frac{33{,}000 \times 100}{270{,}200} = 12.2 \text{ per cent.}$$

is made to do useful work in the cylinder. We have seen that about 69 per cent. of the heat of combustion is transferred to the steam in the boiler, hence about 18 per cent. of the heat of steam is made to do useful work. The coal consumption per indicated horse-power per hour is about 4 pounds with surface condensing engines using steam of 30 pounds gage pressure; 3¼ to 3½ pounds of similar engines of best make and large size; 2¼ pounds with compound engines of moderate size; 1¾ pounds with large compound engines, and 1½ pounds with triple-expansion engine. With this data you can make your own computation for the other classes of engines.

(370) R. J., New York, writes: Please give me the simplest method of computing the weight required at one end of the lever for counterbalancing the steam pressure, say, 80 pounds, acting at another part of the lever. *A.*—Levers may be divided into three classes—in one class we may place all levers which have the fulcrum between the force acting at one end and the weight applied at the other; in another class we may place all levers which have the weight between the applied force and the fulcrum; and all levers which have the applied force between the weight and the fulcrum may be placed in the third class. Now, for all these different classes of levers there is just one simple fundamental rule or formula which will enable us to solve any problem relating to the equilibrium of levers, such as may occur in practice. The rule is: The force multiplied by its distance from the fulcrum is equal to the weight multiplied by its distance from the fulcrum. Of course, these distances must be measured in every case from the points of application of the force and weight. This rule will appear much plainer by expressing it in symbols, thus:

$$P \times a = W \times b; \qquad (1)$$

in which P denotes the force in pounds, a the distance in inches from this force to the fulcrum, W the weight in pounds, and b its distance in inches from the fulcrum. To show the application of this formula, let us take the following example: A force P of 80 pounds is acting at one end of the lever; the distance from this force to the fulcrum is 3 inches, what weight will be required to counterbalance this force, the weight being placed at 20 inches from the fulcrum? Now all we have to do is to substitute for the letters their values as given in the example, and thus obtain the following expression:

$$80 \times 3 = W \times 20.$$

Now, anyone familiar with ordinary arithmetic will readily see that

$$W = \frac{80 \times 3}{20} = 12 \text{ pounds.}$$

In the same way, we can find the numerical value of any one of the four quantities when three of them are known. This formula is also applicable, without making any change, to all classes of levers, but it must be understood that in all cases the distance from the fulcrum to the force must be measured on a line drawn from the fulcrum perpendicular to the direction in which the force acts, so also the distance from the fulcrum to the weight or resistance must be measured on a line drawn from the fulcrum perpendicular to the direction in which the resistance acts. In short, these distances must be the shortest between the fulcrum and the lines of action of the force and resistance. We are inclined to believe that your motive for asking this question is to get rules for solving problems relating to the safety valve lever. The same rule or formula we have given is also applicable in cases of this kind, but since other items enter into problems of this kind, we will take an example. The distance from the center of the weight to the fulcrum is 38½ inches, the weight of this lever is 11 pounds, center of gravity of the lever is 15 inches from the fulcrum, weight of valve and spindle is 5 pounds, distance from center of valve to fulcrum is 3¼ inches, steam pressure on valve is 120 pounds per square inch, area of the valve is 7.06 square inches, find the weight near the end of the lever. First find the total pressure on the valve by multiplying its area by the steam pressure per square inch; this gives us $7.06 \times 120 = 847.2$ for the total pressure on the valve, and this is the numerical value of P in formula (1); the value of a is 3.5 inches, and the value of $b = 38.5$ inches. Leaving the weight of lever and valve spindle out of the question, we then have, according to formula (1), the following expression:

$$847.2 \times 3.5 = W \times 38.5;$$

from this we get:

$$W = \frac{847.2 \times 3.5}{38.5} = 77 \text{ pounds;}$$

that is to say, a weight of 77 pounds will balance the steam pressure on the valve. But this weight is aided by the weight of the lever and the weight of the valve, hence some deductions will have to be made from the 77 pounds, as follows: Multiply the weight of the lever by the distance from its center of gravity to the fulcrum; this gives us $15 \times 11 = 165$. Multiply the distance from the center of valve spindle to fulcrum by its weight; this gives us $3.5 \times 5 = 17.5$. Add 165 and 17.5; this gives us a total of 182.5. Now, according to formula (1) we have, without making any allowance for the weight of lever and valve:

$$847 \times 3.5 = W \times 38.5$$
$$= 2{,}965.2 = W \times 38.5;$$

and making an allowance for the weight of lever and valve, we have:

$$2{,}965.2 - 182.5 = W \times 38.5$$
$$= 2{,}782.7 = W \times 38.5;$$

hence,

$$W = \frac{2{,}782.7}{38.5} = 72.26 \text{ pounds}$$

instead of 77 pounds, as before.

Business Specials

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Gear Wheels, Gear Cutting. Grant; see page 812.

Forming Lathes, Mer. Mach. Tool Co., Meriden, Ct.

Milling Machs. Kempsmith Co., Milwaukee, Wis.

Patent Solicitor. J. G. D. Mack, Madison, Wis.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 98 Cortlandt St., N. Y.

Engrs. should investigate the Korting Condenser. Obtain Catalog from A. Aller, 149 Liberty St., N. Y.

Marine Iron Works, Chicago, builders of steam yachts and marine machinery; catalogs free.

Best Presses and Dies for all sheet metal work. Ferracute Machine Company, Bridgeton, N. J.

Just Issued—Catalog No. 8. Mailed Free. Clayton Air Compressor Works, 28 Cortlandtt., New York.

Squaring and Rotary Shears, Tinsmiths' Tools, Presses and Dies for sheet metal work, are made by the Niagara Stamping and Tool Co., Buffalo, N. Y.

Improved Duplex and Special Gear Cutters in stock and to order; Gear and Milling Cutters of all descriptions. R. M. Clough, Tolland, Conn.

"Hawkins' Aids to Engineers' Examinations, with Questions and Answers," $2 postpaid. Catalog free. Theo. Audel & Co., 91 Liberty St., N. Y.

Key Seaters for any length of hub or width of keyway. New, handy machines. Mitts & Merrill, 913 Tilden street, Saginaw, Mich.

"Practical Drawing," by J. G. A. Meyer; used by engineering schools in lieu of text-book; the set of 92 papers sent to any address in the United States for $5. AMERICAN MACHINIST, 203 Broadway.

Engineers and firemen "The Steam User's Guide" answers all questions asked by a board of examining engineers. Price, postpaid, $1.50; 24 p. pamphlet, explaining contents of book, sent on application. C. G. Krell, 13th and Palm Sts., St. Louis, Mo.

Naval Matters of Interest.

The immediate present is a time of unusual activity and interest in naval and marine affairs. The auxiliary cruiser and mail carrier, "St. Paul," of the American Line, has just had her trial, and is now qualified to carry the United States mails at four dollars per mile. The biggest of our armored cruisers, the "Brooklyn," was successfully launched at the yard of the Cramps, at Philadelphia. It is a rather noticeable coincidence that the "Brooklyn" is, in fact, a greater "New York," following closely the details of its predecessor, but being in many ways an improvement upon them. The "Brooklyn" is about 400 feet long, or 20 feet longer than the "New York;" the extreme beam, 64.68 feet, is about the same as the "New York," while the mean draught, 24 feet, is 8½ inches greater. The normal displacement is 9,271 tons, or 1,071 tons more than the "New York." The engines, of the same type as those of the "New York," are designed for 16,000 horse-power and a speed of 20 knots. The "New York" developed 17,401 horse-power and 21 knots. The bunker capacity of the "Brooklyn" is 1,753 tons, which would carry her 6,088 knots at 10 miles per hour, or 1,758 knots at full speed. Her armament will comprise eight 8-inch and twelve 5-inch guns, twelve 6 pounders, four 1 pounders, four Gatlings and five torpedo tubes. The contract price for the hull and machinery of the "Brooklyn" was $2,986,000, or $1,000,000 more than the price of the "New York."

The speed trial of the "Indiana" is to occur about the middle of the month. The long deferred trial of the ram "Katahdin" is to come soon after. The contract for the "Katahdin" is very different from that for the preceding vessels as to the speed attained. While the contracts for the cruisers award a premium of $50,000 for each quarter knot above the contract speed, with a strong probability of $200,000 being thus obtained by the builders of the "Indiana," no premium or penalty except that of non-acceptance, if under speed, is attached to the contract for the "Katahdin." It is not known when the torpedo boat "Ericsson can be tried, as the effects of the latest of her mishaps have not yet been remedied. Of the three seagoing torpedo boats authorized by the last Congress, the contract for two of them having been awarded to the Herreshoffs at $140,000 each, the third is to

be built by Moran Brothers, Seattle, Washington. This firm supplied the pumps and other machinery for the United States dry dock at Port Orchard, Puget Sound. One of the centrifugal pumps for that work, it will be remembered, was illustrated in the AMERICAN MACHINIST June 27th.

Steam Engine Frame and Cylinder Tools—IV.

By HERMAN LANDRO.

AT THE PROVIDENCE STEAM ENGINE CO.'S SHOPS.

The Providence Steam Engine Company has done business for a great many years on the ground where its shops now stand. The shops have a few very old tools and a great many very fine new tools, and the engine handles its flat valves in a very new and even surprising manner, inasmuch as the steam valves are flat grids moving in lines parallel to the piston travel, while the exhaust valves, although they are also plain grids with flat working faces, are fitted into round seats bored in the cylinders, and move in lines at right angles to the line of piston travel; this curious idea of moving the steam and exhaust valves in planes at right angles to each other leads to a very unusual and very pretty valve gear, with which this article has nothing to do, and also leads to interesting shop operations. The one very old idea of a plain slide valve, wholly unbalanced as the most suitable agent for steam distribution, is about the only old idea now embodied in the constructions of the Providence Steam Engine Company.

The engine is of the modern 3-member type, the cylinder forming the first part, the guide carrying span or girder forming the second piece, while the main pillow block forms the third piece. The flat grid admission valves are placed on top of the cylinder, and the steam chest walls are cast solid with the cylinder; these valves are, however, operated with a quick-action release gear of very elegant design.

If four flat valves are to be used for the admission and exhaust of a steam cylinder, two at each end, it is very easy to put the plain grid admission valves in steam chests with ordinary covers on top of the horizontal cylinder, as there is nothing in the way of the covers; again, the Corliss valve makes a very convenient construction for the exhaust valves, the round valve chambers extending across the under side of the cylinder at each end, making very suitable short legs under the cylinder; hence, to secure this structural convenience, the Providence steam engine retains the bored exhaust valve seat, and fills it with a grid valve seat and a grid valve fitted to move lengthwise on this grid seat, the two together having a circular cross-section so as to fill the bored seats approximately, and thus reduce clearance to the lowest dimensions possible with the chosen form of construction; both the exhaust valve and its seat can be easily removed from the cylinder by taking off the valve seat heads, and by the means adopted four flat valves are made as perfectly accessible as if the usual Corliss valves were employed.

Part of the Providence Steam Engine Company's shops are old and dark, and contain some very old tools still in excellent working condition and also in constant use; it must be remembered that Providence is one of the old machine towns of the United States, and many a strange tale of the Old India Wharf Shops and the Builders Iron Foundry might well be told in these columns, but there were no photographs of the interesting old tools taken for use in this connection; the camera was ordered into the domain of the new, far from the storied realms of the hoary ell, and Fig. 1 is a much too small scale view of the fine new erecting floor, which constantly increasing business has warranted the Providence Company in adding to their plant within the last two years; perhaps the only case of a steam engine plant enlargement during the late hard times. The new addition is a lofty, well-lighted brick structure, the floor of which is covered by a fine electric 100-ton traveling crane. A very much larger engraving than that here given would be needed to do justice to this view of the floor, taken when a number of large engines were in process of erection. Fig. 2 shows the manner of finishing the girder portion of bed. Various methods of dealing with this piece are in use in different shops; in some the planer work on the guides is done first, and the work on the girder ends is squared from the planer cut; in Fig. 2, the girder is shown in a large lathe, on centers, a lug being cast out on the crank side of the girder at the pillow block end to take one center, while a place is found for the other close to the inside edge of the ring which bolts to the front cylinder head, all as very clearly shown in Fig. 2. The lathe is very long, reaching entirely across the width of the shop, and having two head stocks and two tail stocks on it, so that it can be used on shorter work as two independent lathes; as shown in Fig. 2, the front head stock and the two foot blocks are crowded close up together to make room for the long girder shown in process of being faced at the cylinder end. After facing up at both ends, the girders are put on centers on the planer and planed up; this operation involved no points of particular interest, and was so lighted as to make a satisfactory photograph an impossibility. The angular cuts for the guides are very easily made, and the placing of the girder on the same centers used for facing in the lathe, brings the planing and the facing infallibly true with each other.

The drilling on the girders and fly wheels and work generally which is too large to handle easily, is done with the rope-driven portable drillers shown in Fig. 4, in the act of drilling off the centering lug on the pillow block end of a girder.

As shown by Fig. 2, the Providence girder is a very simple piece, and the method adopted of finishing on centers makes all of its surface alignments certain to be right if the planer centers are correct, so that all the spots for the governor, valve gear pedestals or brackets, and so on, are always in line with the guides and cylinder.

The pillow blocks are a simple enough job of planing, being all square work and requiring only the work of a careful planer hand to bring them out in good shape. It is essential that the drilling on the pillow block for the girder bolt holes should be very good, and this drilling is done on a large double column Niles Tool Works drilling machine, shown in Fig. 3. The arm has a power elevation on the columns, and a power horizontal traverse of the spindle saddle on the arm, in addition to the usual power feed on the drill spindle. The circular work-carrying table is mounted to revolve on a square carriage, which is fitted with a hand gear traverse action toward and from the drill spindle.

The portable drillers used in these shops are the "Dallett," and appear to be wholly satisfactory.

The cylinder, valve and fly-wheel constructions of these shops are all of interest, and will be given with some other special features of finishing, in continuations of this fourth paper on engine frame and cylinder tools.

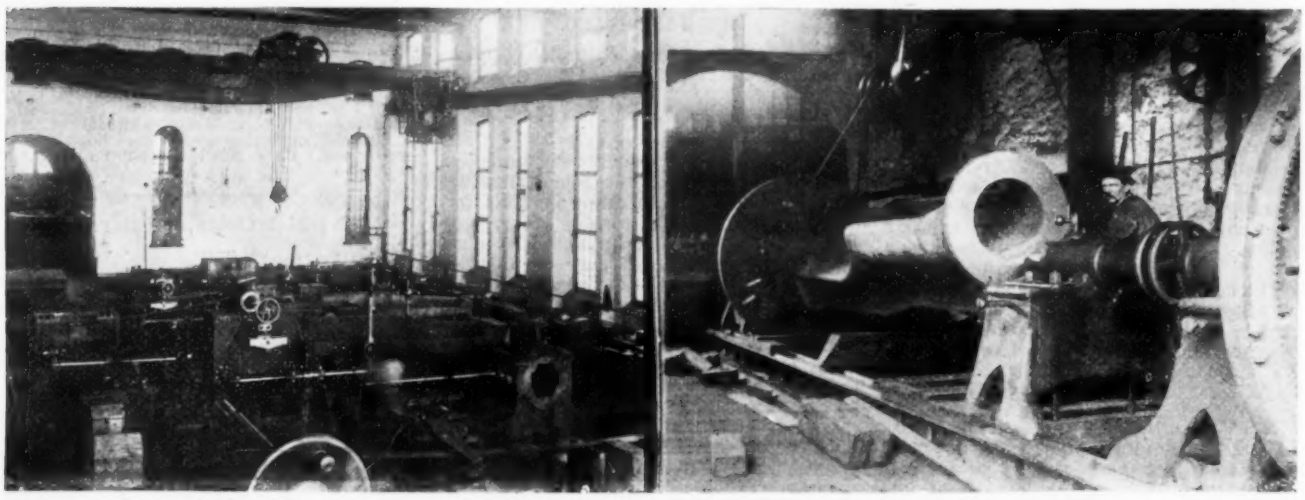


Fig. 1.

Fig. 2.

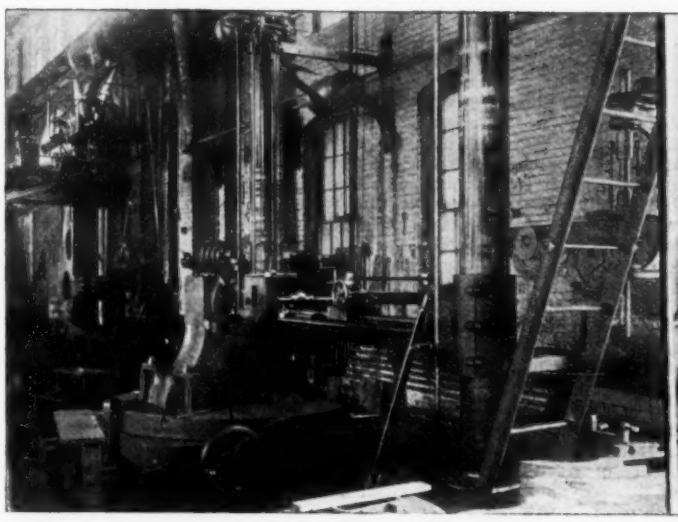


Fig. 3.

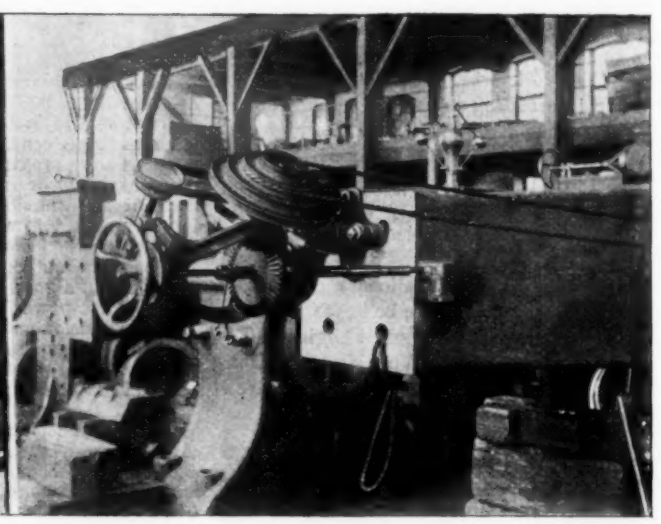


Fig. 4.

ENGINE FRAME AND CYLINDER TOOLS.

Dies and Die Making—I.

By J. L. LUCAS.

It is my purpose to set forth in a few articles something of the art of die making as now practiced in this country. In doing this I am fully aware that I shall meet the criticism of experts, some of whom are probably better informed upon the subject than I am. More accustomed to the file than to the pen, nevertheless I shall do the best I can, not pretending that all the methods I shall illustrate and describe are the best possible ones, but only that they have been proven by a somewhat extended practice to give good results.

MAKING A PLAIN PUNCH AND DIE.

Having found a brand of steel that we know is suitable for the work we have to punch, it should first be machined to the proper size and shape, which will depend on the class of work it is to do, and the style of die shoe it is intended to be used in. A good way, and one that is adapted to a large class of work, is to bevel the edge of the bar to an angle of 10 degrees, leaving the ends as they come from the forge or saw; a good way to get out these blanks cheaply is to cut the steel up into two or three-foot lengths, plane up and bevel the edges to the proper angle, and then saw off as wanted to the required lengths. This style of die can be held by a key or set screw, whichever the practice may be.

The upper surface of the die should be finished on the surface grinder if there is one, or by hand with the use of the file and scraper, as the time thus spent is well saved in laying out the die, since the work can be laid out far better and more distinctly than on the rough machined surface of the blank.

The surface of the die is now covered with what the die maker calls his 'bluing," which is really sulphate of copper solution, and is made by dissolving sulphate of copper or blue vitriol in water (a proportion of ten parts of water to one of crystals makes a good solution), this leaves a thin deposit of copper on the surface of the steel, making an excellent surface for laying out the die. The outline of the piece to be punched should now be laid out on the upper surface of the die; care should be taken in laying out to avoid waste of metal, also so that the grain of the metal to be punched will run in the proper direction so that the stock can be easily prepared for punching. A margin equal to the thickness of the metal to be punched must be allowed between the blanks, and if the stock is $\frac{1}{16}$ or less it is better to increase this proportion.

The die being neatly laid out from either the drawing or a template, all round corners should be drilled with a drill of the proper radius to leave the corner the shape wanted, and then reamed with a reamer of the proper taper to give the die the clearance wanted; the rest of the stock is then removed by drilling. Every die maker has a way of his own for this part of the work; one will drill so that the holes will cut into each other, and thus avoid broaching, while the

next man will drill his holes so as to leave $\frac{1}{32}$ inch or more between them, and then cut out the stock with a flat, square-ended tool he calls his broach; this, I think, is the best and quickest way. The bulk of the stock being removed, if there is a die sinker in the shop, the die can be partially finished on it, and by using a mill of the proper taper the necessary clearance can be given; this will vary from $\frac{1}{4}$ degree to 3 degrees; the large clearance is given when it is essential that the blank shall drop from the die before the next piece is punched.

The die, being carried as far as the machine will do it, is now finished with the file, using a die square (see sketch) to give

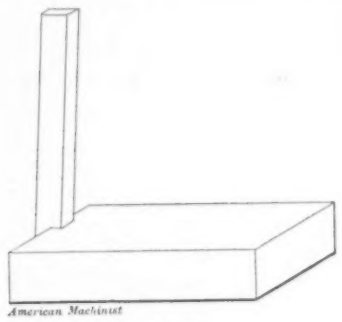


Fig. 1.

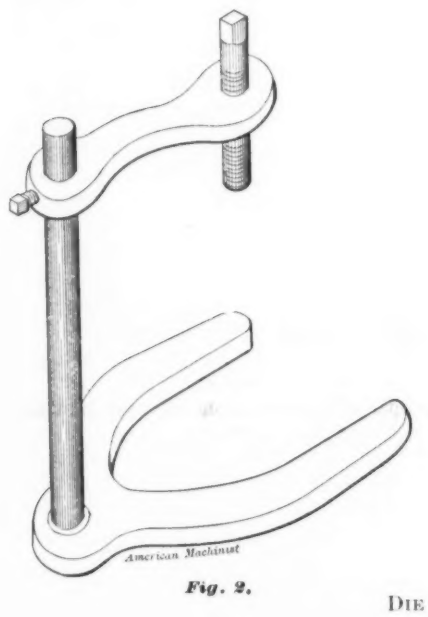


Fig. 2.

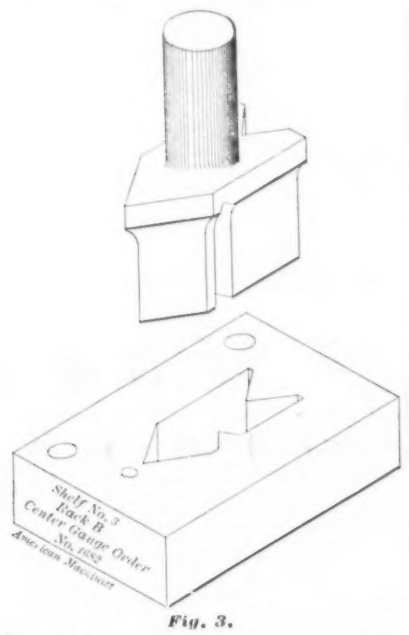


Fig. 3.

DIE MAKING.

it the proper clearance, and if the shape is an intricate one that must be closely followed, a template made of thin sheet metal and soldered to the end of a bent wire will be found a help in making to the required shape.

The tapped holes for the stripper bolts and the hole for the stop pin should now be put in, and if the work to be punched is heavy a cutting shear should be given the die, which should equal the thickness of the stock it is intended to punch, and can be given from one or more points, as the nature of the work may decide.

If the die is for a pressroom using a large number of dies, it should be marked with a shelf and rack number, so it can be quickly found by the die setter, and is then ready to harden.

So much has been said on the subject of hardening steel that I am disposed to let it alone, but feeling that a work of this kind would not be complete without it, I will give the results of my own experience. For heat I prefer a gas furnace of any good make, but, this not being available, a clean charcoal fire is nearly as good.

Fill all holes in the die that you do not wish to have a cutting edge, as the stripper holes, etc., with fire clay; use plenty of good hardwood charcoal, heat slowly but steadily to an even red (don't let it soak in the fire while you go to get a drink, and don't rush it through because the whistle blows for quitting time and then tell the boss that the steel had a flaw in it). Dip it entirely below the surface in salt water; for while there are baths that are good for special work, steel that will not harden in clean salted water is not fit to make a die of. Keep it in the water until it is entirely cold, then put it on the fire again and warm it until the heat is as great as the hand can bear, then cool off and polish and draw to a light straw; the object of the second heating is to lessen the liability of fire-cracking.

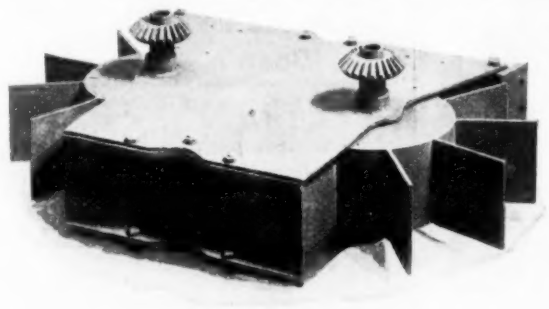
FITTING THE PUNCH.

The die being finished, the blank for the punch, which, if the shape of the die demands it, should be a forged one (but, if possible, I prefer to cut from the annealed bar), should be machined on both ends and one end finished and coppered. Then clamp it firmly on to the face of the die, using a die clamp if there is one (see sketch Fig. 2); now scribe through the die and mark the outline of the punch on the finished end of the blank. This should be nicely marked with the center punch.

The stock can best be removed by the use of the milling machine, as a base or shoulder, of the same shape but of a larger area, can be more easily left with this tool than with the shaper. The object of this base is to give the punch a better support and increase the length of time it will run.

The stock being removed close to the lines the punch may be placed over the die and then forced into it $\frac{1}{16}$ inch, thus giving a "witness mark" to file to; this is called "shearing in," and is the method usually followed in this country. The reverse of this operation, known as the "French way," consists of finishing and hardening the punch and then broaching out the die with it. The results obtained by this practice are not so accurate as by the first described process, as the die will change to a greater extent in hardening than the punch, and is not so easily finished out.

The punch should now be carefully filed to the lines formed by the "shearing in" process, and, if the work requires, should be



PROPELLER.

hardened, but it should in all cases be left softer than the die. When possible the punch and shank should be in one piece, but if not, care should be taken to see that it has a good bearing on the punch back and is held firmly to it.

I give here a cut showing a plain die for blanking out a tool that we are all very familiar with. No stripper is shown, but the two holes at the back are intended to hold one on; the letter "C" denotes the brand of steel that the die is made of, and is very useful in keeping a record of the results obtained from the different brands of steel, of which I shall have more to say next time.

A Novel Propelling Device.

The following description of a new method of propulsion will be of interest to our readers. The invention referred to has been brought out in England and is described as follows:

The method consists of armed wheels, or impellers, fixed in recesses at the sides of the vessel, worked horizontally and entirely submerged. The impellers working horizontally places the propelling quality on an equal with the moving of the vessel; the action thus becomes a natural one, like a fish or duck swimming. The blades, having a firm resistance, strike the water direct; the water not giving, the vessel must. Thus nearly all the force of the driving power (without lifting, and very little slip) is utilized to propel the vessel, the water in the impeller chambers also assisting the velocity. Three great points are claimed for this method over the paddle or screw, viz., greater speed, less or no vibration, and less workable cost.

The accompanying illustration seems to embody the same or a similar method of propulsion as invented by Mr. Robert Rhett, of 71 Beaver street, New York City. The flat box shown is to be built into the bottom of a boat near the stern, the inclosed part coming within the boat, while the blades of the wheels project out on each side. The two spindles are to be geared together and driven by a steam engine or any suitable motor. The blades of the two wheels lap into each other and are so geared that they will not come in contact. We show it merely as a matter of interest to mechanics, and do not wish to be understood as expressing views as to its practical value or efficiency.

Small Bench Milling Machine.

We give herewith an illustration of a small bench milling machine, the features of which will be readily understandable from the engraving.

It is, of course, designed for experimenters, inventors, and others having only light work to do and where a universal machine is not a necessity.

It answers well for cutting small gears, pinions, fluting taps, etc. Work $3\frac{1}{2}$ inches diameter and 3 inches long can be held upon the centers. Vertical adjustment $1\frac{1}{2}$ inches. The machine is $12\frac{1}{2}$ inches high and weighs 30 pounds. There is a countershaft and a vise is furnished if desired, this vise having jaws $\frac{3}{4}$ inch deep, $2\frac{1}{2}$ inches wide and opening $1\frac{1}{8}$ inches. The machine is made by the Richards Mfg. Co., 220 Fulton street, Brooklyn, N. Y.

American Locomotives in Russia.

We learn that the Baldwin Locomotive Works have lately closed contracts for forty locomotives to go to Russia. The names of the railways for which the engines are to be furnished are not made public, but as the Government practically controls all the railways the order is apparently due to the same influences or considerations which placed the orders for armor plate with the Bethlehem Iron Company. The Baldwin Works recently built several engines for the Trans-Caucasian Railroad, which is also controlled by the Russian Government. The forty engines now ordered are to be of the heaviest Vauclain compound type, twenty being for passenger service and twenty for freight. As petroleum is used principally in Southern Russia the locomotives will be fitted for burning oil instead of coal.

Bids for Gun Forgings.

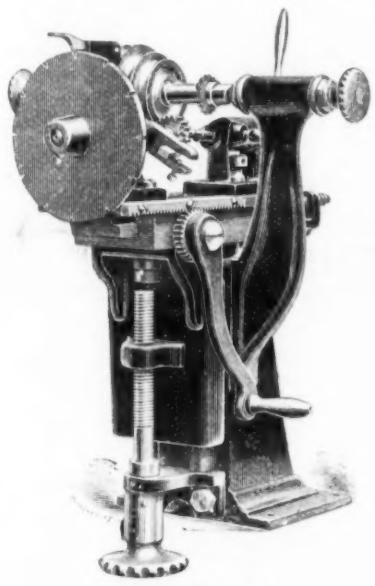
Bids were opened at the Navy Department on the 3d, for supplying thirteen sets of steel forgings for 5 inch rifles, and twenty-seven sets of forgings for 4-inch rifles. The bids were as follows: Bethlehem Iron Company, of Pennsylvania, for the 5-inch forgings, 29 cents per pound, deliveries to begin in 90 days, and be completed in 150 days; 4-inch, 29 cents per pound, deliveries to begin in 120 days, and be completed in 150 days; Midvale Steel Company, of Pennsylvania, for the 5-inch forgings, 30 cents per pound, deliveries to begin in 100 days, and be completed in 175 days; 4 inch, $28\frac{1}{2}$ cents per pound, deliveries to begin in 100 days, and be completed in 175 days.

This will give the contract for the 5-inch forgings to Bethlehem, and for the 4 inch to Midvale, which was probably the intention.

The Flexible Scale—Rope Brakes.

Mr. Clough points out that a piece of paper rolled round a cylinder will prove if measured flat to be of greater length than the circumference of the cylinder. This ought to be so, and if the coefficient of compression of paper is the same as its coefficient of extension the true length of a wrapping of paper will be measured by the diameter of the cylinder plus the thickness of the paper. In other words, the middle of the thickness of the paper is the diameter of what we may term the pitch circle. Mr. Clough says that the length will be as much greater as is measured by the addition of a length of three thicknesses of the paper. With the above assumption of equal coefficients the actual additional length would, of course, be 3.14159 times the thickness. An amusing illustration of this question has recently appeared in a discussion in the technical papers on this side.

It appears that a French engineer had been making some brake trials, and it was incidentally mentioned in a French journal



BENCH MILLER.

that the circumference of the brake rope was measured at the middle of the rope thickness, and one of the English journals called attention to this as correct, especially where ropes of any serious diameter are employed upon a small pulley when the ratio of the true diameter to the diameter of the pulley rim will be far from equality. Thus an inch-rope on a 50-inch pulley will represent a difference in the power of 2 per cent. A correspondent at once wrote to the paper in a superior tone, and denounced what he was pleased to call an error, and he was promptly backed up by another and unfriendly journal, which argued that the true brake diameter was the diameter of the pulley rim. Obviously both the correspondent and his supporter were wrong. The true radius for a brake strap is measurable at the middle of the thickness, because when unwrapped from the rim the length of a circumference of rope will be greater than the wheel circumference, and the distance traveled by the restraining weights, if they were dragged round by the pulley, would be measured by the rope—not by the pulley. The thing is familiar enough to practical men who have had anything to do with belts, and know that they cannot calculate speeds from the actual pulley diameters, but must allow for the belt thickness, and in bending ⊥ and L iron it is well recognised that there is a particular point at which to measure the true diameter, the actual length being measured at the radius occupied

by the neutral axis of the section. Quite a pretty quarrel sprang up round the question, and after the correspondent had been finally convinced that he was in error, he kept on trying to show under what circumstances he would have been right, as for example, if there were no such thing as friction, and no such thing as rigidity of rope, in fact, nothing of anything which the engineer lives to deal with. Sometimes it is not perhaps quite plain in what way to deal with questions of this kind, involving wrapping connectors, but it is best to consider what will be the amount of movement taking place. We cannot get back of the fact that weight × distance moved is the true measure of work done.

London, England. W. H. Booth.

Inventor of the Yost Typewriter Dead.

George W. N. Yost, the inventor of the typewriter bearing his name, died in this city September 26, 1895. Mr. Yost was born in the western part of this State sixty-four years ago. His father was a farmer, but the boy early developed mechanical tastes, and found employment in the shops then building the Acme mower and reaper. He suggested various improvements and secured an interest in their manufacture. Later his inventive abilities produced the typewriter. From this he is said to have realized a fortune, which he lost in various speculations. He later organized a typewriter trust and accumulated a second fortune, but is said to have died a comparatively poor man. Mr. Yost united the genius of the inventor with the business instincts of the shrewd merchant, but he had a love for abstract speculation which entangled him with designing persons, and brought his name before the public as a victim of his credulity or infatuation.

He had much to do also with perfecting other prominent typewriting machines now on the market.

NEW CATALOGS.

There are three sizes of Standard Catalogs, 9″ × 12″, 6″ × 9″ and 4½″ × 6″. We recommend the 6″ × 9″ size for machinery catalogs. When they must be larger or smaller, one of the other standard sizes should be adopted if possible.

The Frick Co., Waynesboro, Pa., have issued a new catalog illustrating and describing their high-speed automatic steam engines. In this catalog are a number of views of the shops in which the engines are built, and the engine itself is thoroughly and well illustrated and described. The catalog is in many respects above the average in value and interest. It is probably intended to be standard size, but measures 5⅞″x9⅛″.

We have received from the Prentiss Vise Co., 44 Barclay street, New York, a new illustrated catalog and price list of vises made by this company. The vise is, of course, well known to machinists, but we find that this catalog contains illustrations of a number of new styles of vises, some of which are especially designed for use of machinists. We notice particularly the "Machinist's bulldog vise," which is a new style, and some vises for various purposes, which have wrought-steel channel bars, in place of the usual cast bar, thus making a very strong and rigid vise. Such a vise is in one form made especially for filers' use, having relatively high and slim jaws, with a deep opening. It is made either with a solid or swivel base. Other new forms of vises appear in the catalog, which is well gotten up. It is 5¼″x6½″, and is sent to those interested on application.

MANUFACTURES.

At Zanesville, Ohio, the Zanesville Cycle Co. has recently been formed.

The National Mfg. Co., of St. Louis, Mo., will shortly add a machine shop to its plant.

The Horix Manufacturing Co. has been organized at Cleveland, Ohio, with a capital of $25,000.

The West St. Louis (Mo.) Machine and Tool Co. has been formed by Augusta Hardman and William Eves.

The Spathite Iron Co., of Sheffield, Tenn., has been organized by Thomas Sharp, H. W. Buttorf and others.

At Elmira, N. Y., the Elmira Safety Appliance Co. has been organized to manufacture electrical engine stops, etc.

John G. Williams and others have in contemplation organizing a company to build a cotton-mill at Cross Hill, Texas.

At St. Louis, Mo., the Star Wrench Co. has been organized, with a capital of $30,000, by S. M. Friede and J. W. Donnell.

The Pomeroy (Ohio) Iron and Steel Co. has lately been formed with a capital of $100,000, by W. A. Taylor and Myram C. Wick.

The Superior Foundry Co., of Albany, N. Y., has been incorporated by Victor Adams and F. H. Burrows, with $20,000 capital.

The Oennger Manufacturing Co., of New York City, has been organized by Albert Hartman and B. Block, with a capital of $50,000.

The Kuhlman Safety Coupler Co., of La Crosse, Wis., has been formed by C. F. Klein and Adolph Kuhlman, with a capital of $100,000.

The Hartwell Range Co., of Pegran, Ill., has been incorporated by Jas. O. Cole and Joseph Rosenthal, with a capital of $50,000.

The Gates Electric Manufacturing Co., of Chicago, Ill., has been formed by D. V. Samuels and J. H. Gates, with a capital of $25,000.

E. E. Bryant and Isaac Isaacson have incorporated the American Track Joint Co. at Little Rock, Ark., with a capital of $250,000.

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MECHANICS,
Read
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MANUFACTURE
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ELECTRIC, STEAM AND PULLEY TYPES, GREATEST AIR VOLUME, LEAST POWER
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Crescent Steel Co.
STEEL of remarkable purity and strength for costly tools and dies.
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NO BETTER MADE ANYWHERE.

STEEL CASTINGS OF EVERY DESCRIPTION.
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ARE SUPERIOR TO LATHES FOR FACE PLATE WORK.
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Ready Made Iron Gears.
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Gears Made to Order.
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1895 Gear Book, Free.
Treatise on Gears, $1.00.
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Star Lathes
Foot-power Screw Cutting Automatic Cross Feed
9 and 12 inch Swing.
New Designs. Novel Features.
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H.W. JOHNS' ASBESTOS BOILER COVERINGS
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The Mississippi Valley Cycle Co., of St. Louis, Mo., has been organized by Mark Leavenworth and Frank J. Kaiser, with a capital of $50,000.

The Hucomuga Cotton Mills, of Greensboro, N. C., has been incorporated, and has elected J. S. Hunter, president, and E. T. Garsed, secretary.

The Hennegin Engine and Mfg. Co., of St. Louis, Mo., has been incorporated by Peter Hennegin, J. R. T. Nichols and others, with a capital of $100,000.

The Springfield Engine Stop Co. has recently been organized at Augusta, Ga., with a capital of $15,000. Jno. D. Miller is president, and M. J. Carroll, treasurer.

Thos. Kennedy, of Cohoes, N. Y., has purchased the business, including the stock, machines, tools, and patents, of the late H. N. Bruce of the same place, and will continue the business of building and repairing machinery for the knitting and corset trade.

The Brownell Co., of Dayton, Ohio, are building an addition to their plant, so as to be able to take care of the increasing demand for their boilers and engines. They have closed a deal with the Lodge & Davis Machine Tool Co., of Cincinnati, Ohio, for the necessary machinery to equip the new addition.

The Croton Valley Electric Railway Company has been organized to construct a narrow gage street surface railroad, about four miles long, from the New York Central Depot in Croton-on-Hudson to the New Cornell Dam; capital, $10,000; directors, Charles E. Grattan, Edward White, Robert B. Wright, and others, of Croton-on-Hudson, N. Y.

An indication of returning prosperity may be found in the fact that the E. W. Bliss Co., of Brooklyn, recently ordered of the Niles Tool Works, through their representative, Jesse L. Law, of 86 Liberty street, New York, eight large and heavy planers. These are intended to double their capacity in the line of work for which they are intended.

The W. C. Leffel Co., of Springfield, Ohio, which has not been as active in the past two years as it might have, has decided to reorganize the management and infuse some new business ability and enterprise into the affairs of the concern. The new organization will be known as The Trump Manufacturing Co., and has a capital of $100,000. It will manufacture engines and water wheels. The officers elected are John J. Hoppes, president; Wm. Conklin, vice-president; Fuller Trump, general manager; Paul A. Staley, treasurer, and Percy Norton, secretary.

Machinists' Supplies and Iron.

New York, October 5, 1895.

Iron—American Pig—We quote standard Northern brands, $14 to $14.50 for No. 1; $13 to $13.50 for No. 2; $12.75 to $13.25 for No. 2 Plain, and $12.50 to $13 for Gray Forge. Southern brands, $14 for No. 1; $13.50 to $13.75 for No. 2; $13 to $13.50 for No. 3; $13.50 to $14 for No. 1 soft $13 to $13.50 for No. 2 soft; and $12.50 to $12.75 for Foundry No. 4.

Antimony—Prices are fairly steady; business is moderate. Cookson's is quoted at 8c.; Hallett's at 7¼c., and Japanese at 6⅞c.

Lard Oil—Prime City is quoted at 50c. to 51c.

Copper—The market is inactive, but inquiries from consumers are increasing. Lake Copper is quoted at 12¼c., and Casting Copper is held at 11¼c. to 11¾c.

Lead—The market shows signs of improvement. For New York delivery, 3.32½c. to 3.35c. is quoted, but bidders held out at 3.30c. for large quantities.

Spelter—The market is dull and weak. Holders are more liberal in their offerings; good Western brands are quoted at 4.25c. to 4.30c. for spot or for early delivery.

Tin—The market is steady and prices have stiffened. For 5-ton lots and early delivery 14.50c. to 14.55c. has been paid.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

TO SUBSCRIBERS.

On and after July 4th this paper will give two free insertions under this heading to those in want of positions. The advertisement to occupy a space of not more than five lines. Additional space or insertions must be paid for in advance at regular rates.

Wanted—Bright, active machinists to canvass for subscription to American Machinist, liberal commission. Address, with refs., Subscription Dep't, American Machinist, 203 Broadway, N. Y.

Practical draftsman desires position; N. Y. City preferred. H. D., care American Machinist.

Draftsman with shop and office experience and technical education wants pos. O. M., Am. Mach.

Experienced Jones & Lamson lathe hand wants steady situation. Address Box 134, Am. Mach.

Wanted—Position by draftsman (24), tech. education, 5 years' experience. R. S., Am. Machinist.

Wanted—Situation by first-class wood pattern-maker: 20 years' experience. Address S. W. Parks, 64 E. 2d street, Dunkirk, New York.

Wanted—Pos. as foreman patternmaker, American; age, 33, wide exp., specially valve and cored work. 1st-class refs. Energetic, Box 133, Am. Mach

Wanted—Man to travel and sell passenger and freight elevators for a firm in Western Illinois. Address Box 135, American Machinist.

Eng'r, designer and salesman, thoroughly posted in steam pumping machinery, single and duplex is open for an engagement. Box 129, Am. Machinist.

Wanted—A working foreman patternmaker for a Texas city. Address, giving wages required, and references, Patternmaker, care Am. Machinist.

A good, live machinist that is capable of handling help in a small shop running about 10 to 15 men, doing repair and special work. Box 136, Am. Mach.

Wanted—Position as foreman boiler maker by experienced man, A1 layer out, modern methods and ideas. Address Box 138, American Machinist.

A young man, with business ability and experience as mechanic, draftsman and foreman, wishes employment. J. F. Lisk, Box 311, Palmyra, N. Y.

Wanted—Sit. as first-class patternmaker, familiar with machine and valve work. Postal address Von Yerndohl, 23 Benhom Ave., Bridgeport, Conn.

A mechanic well up in machinery manufacturing processes, and experienced in positions of responsibility, would like to make a change. Best of references. Box 132, American Machinist

Pos. by 1st-class mach. and tool maker, thorough knowledge of ivory button mach'y and tools with some valuable improvements. Large exp. in experimental mach'y, fair d'ftsman. C. H. B., Am. Mach.

Wanted—By a first class machinist and draftsman, a position as foreman. Have held such positions, and can give the best of references. Address Box 137, American Machinist.

Young mech. engr. and steam engine expert, would like to correspond with parties needing some one to do testing and adjusting after October 15. Address Box 125, American Machinist.

Mechanical engineer and draftsmen, age 29, tech. graduate; A1 references and testimonials; exp'd designer of compression ice machines, Corliss and high-speed engines, and gas engines, desires change of situation. Hall, American Machinist.

One who has had a varied experience in the design, construction and repairs of coal mining machinery, is open for engagement, on or after October 1, 1895. Box 126, American Machinist.

A live man up to date in modern foundry work, understanding Keep's tests, desires correspondence with parties in need of a foreman, who are manufacturing special lines of castings. Address Castings, care American Machinist.

Wanted—Situation as superintendent or foreman in or near New York City by a 1st-class practical mechanic, experienced on die and tool work for sheet metal, and building of light or heavy automatic machinery; bicycle, electrical, or experimental work. Address L. D., Am. Machinist.

Wanted—An intelligent man in every machine shop in New England to utilize his spare time in raising clubs of subscribers for the American Machinist; liberal commission. Address, with references, John A. Walker, N. E. Agent, No. 4 Church Street, Dorchester, Mass.

(*Continued on Page* 814.)

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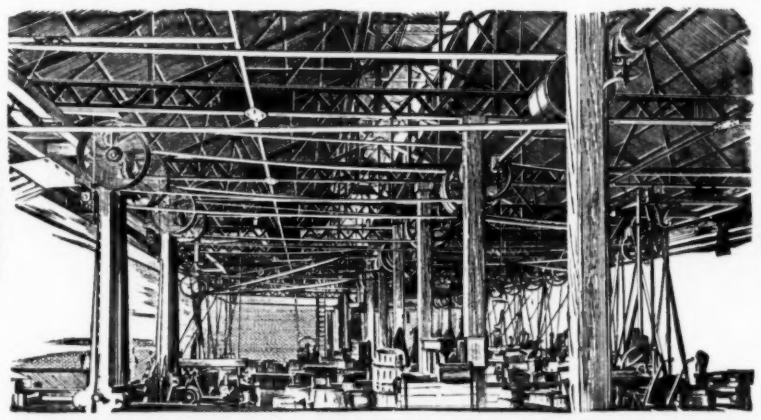

Iron and Steel Bridges and Buildings.

The above illustration is taken direct from a photograph, and shows the construction of an Iron Truss Roof designed and built by us for the Upson Nut Co., at Unionville, Conn., over their Forge Shop. The building is 45 feet in width by 184 feet in length, with brick walls and iron roof trusses covered with corrugated iron. No wood-work is used about the construction in any way, shape or manner, so that the danger from fire is entirely eliminated. Extending the full length of the building, on the ridge, is a ventilator with swing shutters which open and close by cords from the floor.

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ROOTS' NEW ACME HAND BLOWER.
For Blacksmiths, etc. Slow Speed, Positive Blast. Is Durable Compact and Cheap; also Portable Forges, Tuyere Irons and Foundry Blowers.

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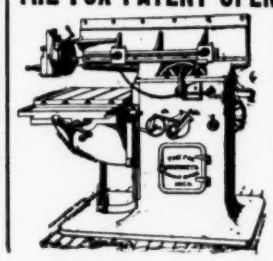

No springing of ram. No overhanging table. Quick Return. Stroke Under Perfect Control. Can be Instantly Adjusted 1-16 in. or 24 in. No Screws to Monkey with. Powerful, Quick, Accurate. Write for circular.
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REDUCED PRICE OF LE COUNT'S HEAVY STEEL DOG

This Dog has a Very Heavy Boss, so that if the thread wears a Heavier Screw can be substituted.

No.	Inch.	Price.
1	3-8	$ .40
2	1-2	.62
3	5-8	.62
4	3-4	.62
5	7-8	.62
6	1	.70
7	1 1-8	.80
8	1 1-4	.85
9	1 3-8	.95
10	1 1-2	.95
11	1 3-4	1.10
12	2	1.25
13	2 1-4	1.35
14	2 1-2	1.45
15	3	1.60
16	3 1-2	1.90
17	4	2.10
18	4 1-2	2.25
19	5	3.25
Full set of 19		$21.60
20 (ext.)	5 1-2	4.00
21 (ext.)	6	5.00

Le Count's Heavy Steel Dog.
With Steel Screws, Lathe Made and Hardened.
When ordering, state as above, whether a full set or a set of 12, or small set of 8. Users of these dogs prefer them to any other make.
One Small Set of 8—by 1-4 inches to 20 inch, $6.25
One Set of 12—by 1-4 in. to 2 in. continued by 1-2 in. to 4 in. 13.25
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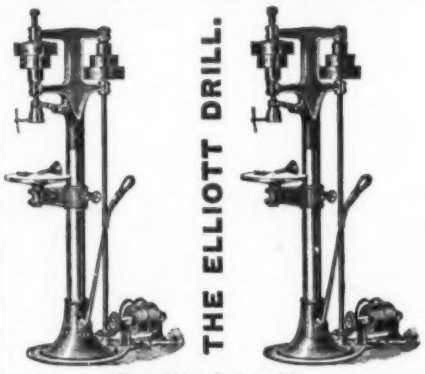
FOR ANY LIGHT WORK.
LARGE RANGE OF WORK—LOW PRICE.



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180 to 188 WASHINGTON ST., BOSTON, MASS.
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FITCHBURG MACHINE WORKS,
FITCHBURG, MASS., U. S. A.
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Labor-Saving Machinery Built
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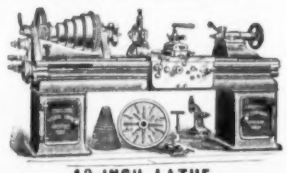

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BUILDERS IRON FOUNDRY,
FOUNDERS AND MACHINISTS,
PROVIDENCE, R. I.
We can guarantee that our castings will be uniform and of high tensile strength.
Tensile strength of ten specimens taken from an air furnace heat:

34,260 lbs.	34,390 lbs.	32,600 lbs.	33,200 lbs.	34,400 lbs.
36,420 "	34,650 "	32,460 "	36,550 "	36,700 "

FOR SALE.
A Large Manufacturing Plant lately used as a Bicycle Works. Large part of Shafting and Pulleys already in position, so that Machinery could be attached and operations begun at once. This property, with water power, is well adapted to many kinds of manufacturing purposes, and will be sold cheap. For further information address, JAS. DICKSON, 98 4th St., Pittsburg, Pa.

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FOR TOOLS, DRILLS, DIES, &c.
ALL KINDS IN STOCK.
Manufactory, SHEFFIELD, ENG.
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WM. JESSOP & SONS, LTD.
Established a century ago.
Medal World's Columbian Exposition 1893.

WORTHINGTON CONDENSER.
ONLY APPARATUS that can MAINTAIN a VACUUM on ENGINES and ELEVATE the discharge WATER to TANK at any height.
This feature is appreciated by PAPER MILLS, SUGAR REFINERIES, COTTON and WOOLEN MILLS.
HENRY R. WORTHINGTON,
NEW YORK, 86 and 88 Liberty St. BOSTON, 70 Kilby St. PHILADELPHIA, 607 Arch St. CLEVELAND, 24 South Water St. CHICAGO, 185 to 189 Van Buren St. ST. LOUIS, Eighth and St. Charles Sts. INDIANAPOLIS, 64 South Pennsylvania St. [illegible] Jefferson Ave.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd lathes & planers. S.M.York, Clev'd, O.

Calipers & Gauges. F. A. Welles, Milwaukee, Wis.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

For Sale—A first-class key-seater, new. Address Mitts & Merrill, 913 Tilden St., Saginaw, Mich.

Best and cheapest Bolt Header made by C. H. Baush & Sons, Holyoke, Mass.

Pat's obt'd; no atty's fee until allowed; exp't service. Thurman & Silvius, mech. engs., Ind'polis, Ind.

Wanted—Machinery to build: special, steam, mill, hydraulic. F.C. & A. E. Rowland, New Haven, Conn.

Scientific and mech books, 2d hand; standard authors; for sale, cheap, send for list. Mrs. O. A. Lamphear, 967 Dennison Ave., Columbus, Ohio.

For Sale—"The Process of Cold Tinning as Applied to Tacks, Nails or any Small Goods of Iron, Brass or Steel." Price, $5. J. L. Lucas, Lynn, Mass.

For Sale—Tabor duplex automatic molding machine with 18-inch cylinder; molds two flasks 12x15, or one flask 15x24 inches; perfect condition. Box 94, AMERICAN MACHINIST.

For sale—Second-hand tools as follows: One 24x24x5-foot planer, and one 15-inch by 5-foot engine lathe. Traverse City Iron Works, Traverse City, Mich.

For sale—Two 22" Plain Hamilton Drill Presses, one 26" back gear and power-feed Hamilton Drill Press, one 30" Springfield Tool Grinder. These are new machines and will be sold cheap for cash. Dietz, Schumacher & Co., Cincinnati, Ohio.

Introduction and negotiation of American patents and machinery to English manufacturers and agents. Write for circular to Geo. Richards, M. I. M. E., Mechanical and Consulting Engineer, No. 5 Laurence Pountney Hill, London, England.

Wanted—An Idea. Who can think of some simple thing to patent? Protect your ideas; they may bring you wealth. Write John Wedderburn & Co., Patent Attorneys, Washington, D. C., for their $1,800 prize offer.

Wanted—Second hand, double-ended punch and shears: shear 6"x1", punch 1 inch through 1 inch bars, hight throat 14 inches or more, depth under 12 inches; bolt cutter ¾ to 1⅛-inch bolt; foundry cupola 10 tons capacity; crane hoist 5 tons, hight 20 feet, radius 8 to 10 feet. Diamond Truck Co., Kingston, N. Y.

Wanted—To sell large or small interest in first-class foundry and machine works, in mining State, to practical man, having also good business qualifications; young, active preferred. Controls large territory, fine dry climate; altitude, 6,000 feet; population, 6,500. Plant complete, fine condition, present investment, $40,000, good trade, can be heavily increased by right party. Good schools and society. Management to buyer of sufficient interest. Good habits and ability required. Margins high. No. 101, AMERICAN MACHINIST.

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5 Neue Promenade, Berlin, C., Germany.
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BEFORE REMOVAL.

At Phœnix Iron Works, Trenton, N. J.

15 in. x 6	ft. Engine Lathe.		19-36 and 50 in. Drills.
22 " 12	" " "		Portable Drill.
29 " 13½	" " "		26 in. x 14 ft. Planer.
26 " 20	" " "		12 in. Shaper Traverse Head.
37 " 30	" " "		Gear Cutter, 54 in.
71 " 18	" " "		Milling Machine.
52 in. x 20 ft. Engine Lathe.			

10 ft.-16 ft. Vertical Boring and Turning Mill, Cranes, Blower, Boiler Rolls, Punch and Shear, etc.

Send for full list and prices.

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60" Pond Boring Mill, with 2 heads.
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18" x 10 ft. Flather Engine Lathe.
15" x 6 ft. Flather Engine Lathe.
30" x 30" x 8 ft. Whitcomb Planer.
26" x 24" x 7 ft. Wheeler Planer.

Send for complete new list just out.

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Second-Hand Machinery.

LATHES.

2 10 in. x 5 ft. Foot & Power.
2 11 in. x 5 ft. Power only.
1 15 in. x 6 ft. Dustin.
1 16 in. x 8 ft. Flather.
2 18 in. x 8 ft. Flather & Prentice.
3 18 in. x 8 ft. Lodge & Davis.
2 21 in. x 10 ft. Pratt & Whitney.
1 27 in. x 10 ft. Dustin.
1 28 in. x 12 ft. Blaisdell.
2 30 in. x 14 ft. Lincoln.
1 32 in. x 13 ft. Bement Triple Geared.
1 72 in. x 10 ft. Niles.
1 24 in. x 10 ft. Niles.
1 79 in. Driving Wheel, Bement.
1 48 in. x 18 ft. Gay & Silver.

PLANERS.

3 48 in. x 32 in. x 6 ft. Pond, two heads.
1 48 in. x 32 in. x 8 ft. Pond, two heads.
3 24 in. x 24 in. x 6 ft. W & L., one head.
1 28 in. x 28 in. x 8 ft. Gay & Silver.
1 32 in. x 32 in. x 10 ft. W & L.
1 38 in. x 38 in. x 10 ft. Aldrich.
1 32 in. x 10 ft. Open Side.
1 60 in. x 60 in. x 22 ft. Hepworth.

DRILLS.

3 22 in. Back Geared.
2 25 in. " & P. F., Snyder.
1 34 in " " Harris.
2 No. 1½ Niles Radial.
2 Suspension Drills.

MILLING MACHINES.

1 No. 1 B. & Sharpe.
2 No. 13 Garvin.
1 No. 15 "
1 No. 2 " Hand, and others.

SHAPERS.

9 in., 12 in., 13 in., 15 in., 20 in.

MISCELLANEOUS.

1 18 in. P. & W. Screw Machine.
1 20 in x 6 ft. Flather "
2 Horiz. B. & D. Machines.
1 Cylinder Borer P. & A.
1 30 in. Motor Gear Lathe
1 Double Punch and Shear.
1 30 in. Pulley Lathe.
1 Hydraulic Riveter.
2 Bolt Cutters.
1 Nut Tapper.
1 20 in. Pattern Lathe.

Also large stock of other tools. Send for List.

Eastern Branch Niles Tool Works Co.,

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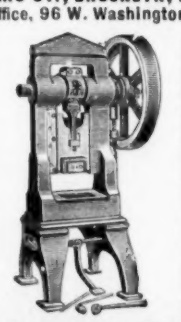
Chicago Office, 96 W. Washington Street.



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BLISS TOGGLE DRAWING PRESS, fitted with the BEST FRICTION CLUTCH ON THE MARKET.

STILES & PARKER PRESS CO.

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ENGINE LATHES.

Fifield Improved Lathe, 25 x 12 Compound Rest.
15 x 6 Blaisdell, Compound Rest with turret; Hollow Spindle.
14 x 6 Robbins Compound Rest, Hollow Spindle, Power Cross Feed.
13 x 6 Ames Rise and Fall Rest, Hollow Spindle.
11 x 4 Mann, Hollow Spindle.
16 x 7 Maker Unknown.
16 x 8 Blaisdell, Plain Rest.
18 x 10 Flather's, Plain Rest, Large Hollow Spindle.
18 x 10 Blaisdell, Plain Rest.
28 x 20 Perkins Power Cross Feed.
37 x 14 Maker Unknown.

PLANERS.

16 in. x 16 in. x 3½ ft. Hendey.
20 in. x 20 in. x 4 ft. Nashua.
22 in. x 22 in. x 4 ft. L. W. Pond.

SHAPERS.

10 in. Juengst, Crank.
12 in. Juengst, Crank.
10 in. Woodland Light, Traverse Head.
18 in. Putnam, Traverse Head.
15 in. Juengst Friction Shaper.

HAND LATHES.

1 10 in. x 41 in. Garvin.
12 in. x 6 ft. W. Light.

HAND LATHES.

12 in. x 5 ft. Back Geared.
1 20 in. x 8 ft. " "

MISCELLANEOUS TOOLS.

24 in. Barnes Water Tool Grinder
Garvin Profiler, 1-spindle.
No. 2 National Bolt Cutter.
60 in. Lincoln Gear Cutter.
26 in. Pulley Lathe.
50 in. Pulley Lathe.
5 in. Cutting-off Machine.
No. 2 Springfield Tool Grinder.
No. 1 Garvin Screw Machine.
36 in. Bliss Power Squaring Shear.
No. 2 C. Worcester Drill Grinder.
21 in. Squaring Shear.
14 ft. Power Draw Bench.
225 lb. Gould & Eberhardt Drop Press.
100 lb. Stiles Power Drop Press.
75 lb. Drop Press.
No. 31 Eaton Double-Acting Press.
No. 2 Garvin Wire Spring Coiler.
No. 6 35 in. Sturtevant Blower.
No. 2 Norton Grinder, with Two Wheels and Countershaft.
1 Diamond Lapping Attachment.
1 Hanson & Van Winkle Polishing Stand.
1 Springfield No. 2 Water Grinder with Trueing Attachment.

Also, a large list of other machines. Write for complete list, detailed description and prices.

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36" Gould & Eberhardt Gear Cutter.
26" Pratt & Whitney Chucking Lathe.
60" Triple-geared New Haven Lathe, with chuck jaws.
40" New Haven Back-geared and Power-feed Drill.
32" Double-head Pond Planer.
No. 1 Giant Key Seater.

Send for complete list. Send for catalogue of Bicycle machinery.

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MODERN STYLE. FIRST-CLASS ORDER.

Will Be Sold Very Low Before Removal.

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" " Pratt & Whitney, 16 x 7 ft., Raise and Fall Rest.
" " Putnam, 16 x 8 ft., Raise and Fall Rest.
" " Flather, 18 x 8 ft., Hollow Spindle, Cross Feed.
" " Pond, 20 in. x 15 ft., Extra Heavy, A 1.
" " Harrington, 20x10 ft., Compound Rest, Cross Feed.
" " Fay & Scott, 36x18 ft., Compound Rest, Cross Feed.
" " Pratt & Whitney, 42 in x 10 ft., Triple Geared, complete, A 1.
" " Hewes & Phillips, 60 in. x 20 ft., Triple Geared, Compound Rest, etc. A 1.
" " Union, 72 x 20 ft., Triple Geared, Screw Feed.
PLANER Pease, 22 x 5 ft., Heavy Pattern.
" Hendey, 22 x 5 ft., Friction, A 1.
" Powell 24 x 6 ft. A 1 order.
" Gould & Eberhardt, 26 in. x 8 ft. A 1.
" Fitchburg, 27 x 8 ft., Automatic Feeds.
" Pond, 32 in. x 8 ft.
" Pond, 36 x 12 ft. A 1 order.
" Betts 36 x 10 ft., Extra Heavy.
" Gray, 48 x 12 ft., "Latest," 2 Heads.
" Betts, 60 x 16 ft., 4 Heads, Extra Heavy. A 1.
" Crank 12 in. stroke, "Pond's."
SHAPER Gould & Eberhardt 15 in. Crank.
" Prentiss 17 in. Crank. Good as new.
" Hendey 24 in. Friction. Good order
" Pratt & Whitney 14 in. x 60 in., Traveling Head, 2 Tables.
" Fitchburg 14 in. Traveling Head, 28 in. Feed.
DRILL—Prentice 26 in., Friction Pulleys for tapping.
" Blaisdell 28 in., Back Gears.
" Hamilton 28 in., Back Gears, Automatic Feed.
" Pond 32 in. Extra Heavy, Back Gears, Automatic Feed.
MILLING MACHINE—Pratt & Whitney No. 2 Hand Feed and Vise.
" " Garvin No. 3, Power Feed, Vise, etc
" " Kempsmith Universal Miller.
" " Lincoln Pattern with Vise.
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SCREW MACHINE—Bardons & Olivers No. 2 Screw Mach., Wire Feed
" " Bardons & Olivers No. 5 with 1 9-16 in. Wire Feed, Friction Back Gears and Turret Feed Complete. "Entirely New."
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" " Gould & Eberhardt, 30 in. Automatic.
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Horizontal Boring and Drilling Machine Sellers 60 in.
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Steam Hammer 300 lb., Ferris & Miles.
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Boiler Rolls, 10 ft., Improved Style, A 1.
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" " 7 ft., Hilles & Jones, A 1.
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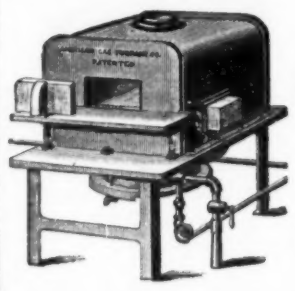

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Lot 6⅛ in. and 7⅛ in. Hammered Steel Shafting.
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Two (2) 5 ft. Universal Radial Drills.
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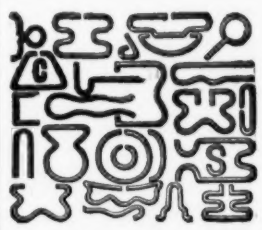

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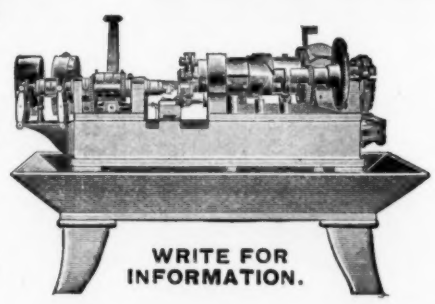

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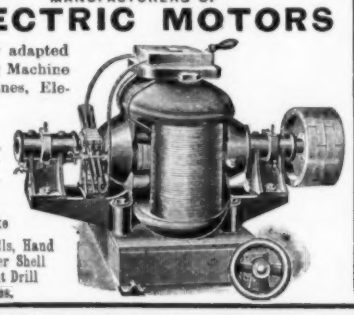

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GEARS of any diameter, face and pitch, made on Gear Moulding Machine—no pattern needed.

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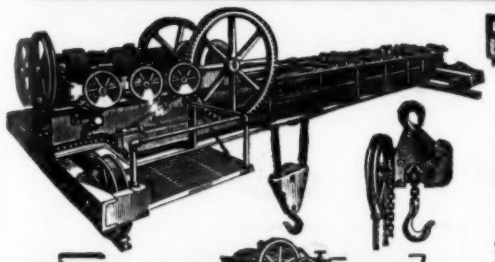

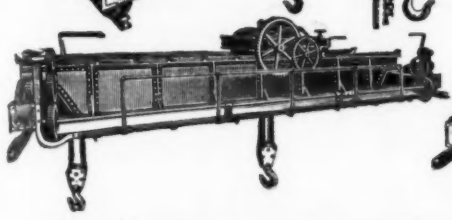

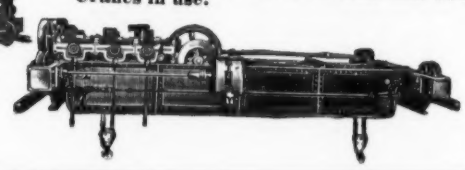

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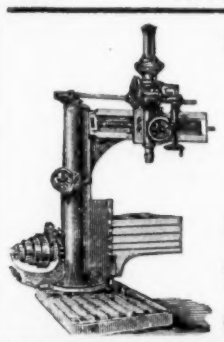

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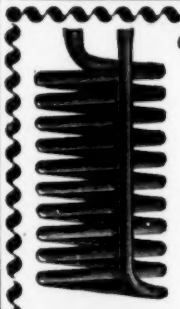

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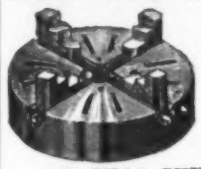

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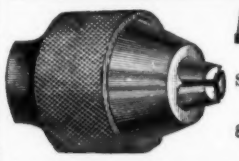

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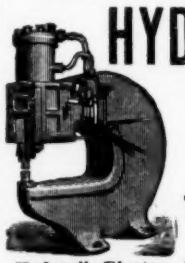

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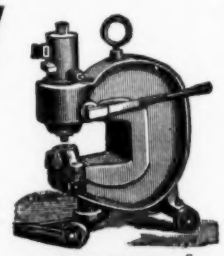

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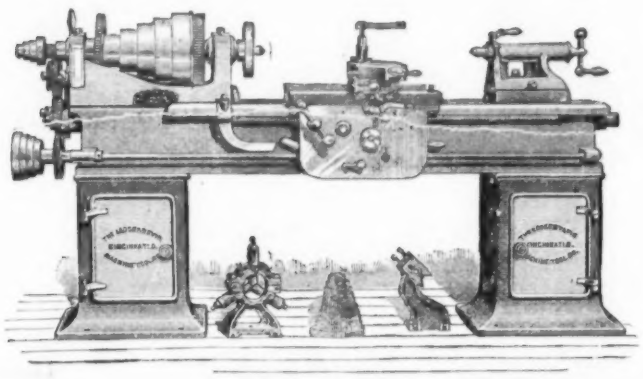

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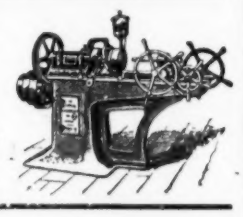

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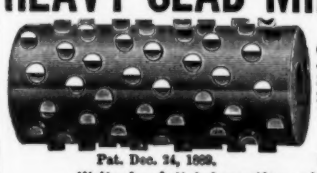

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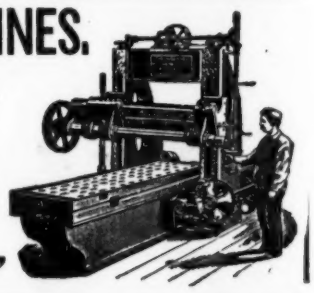

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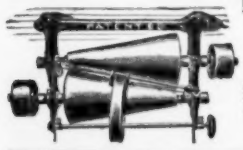

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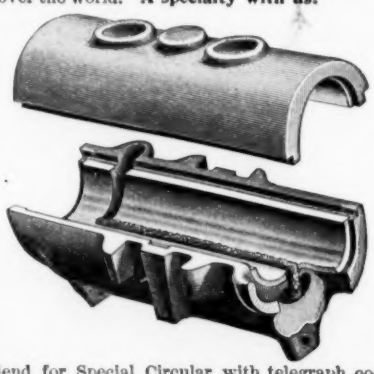

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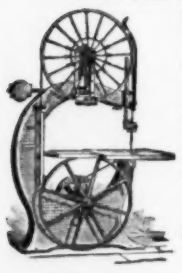

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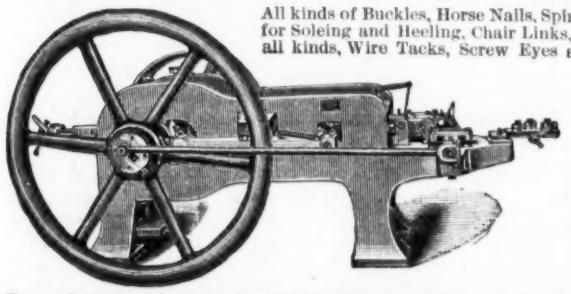

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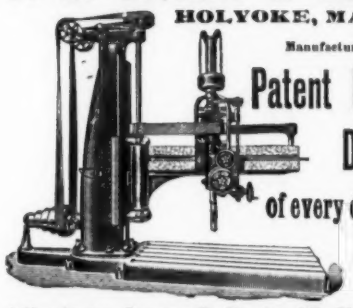

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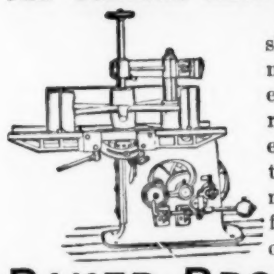

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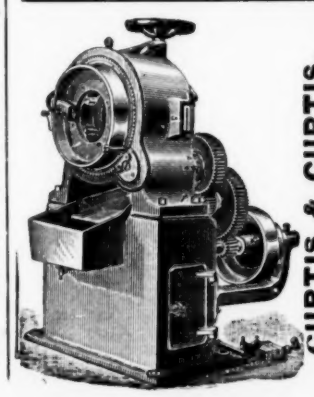

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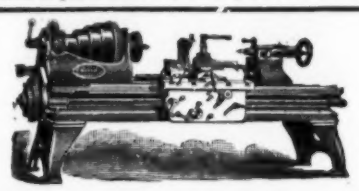

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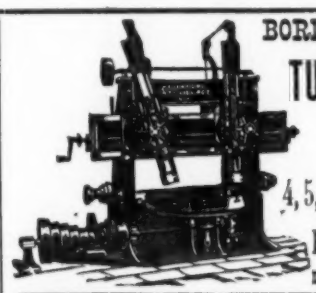

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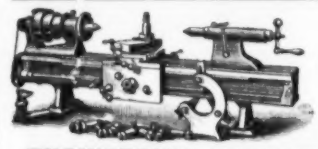

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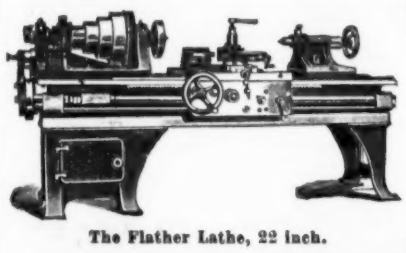

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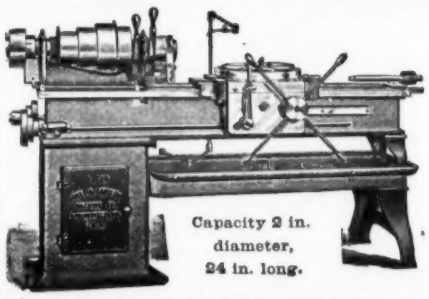

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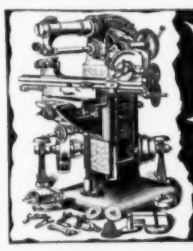

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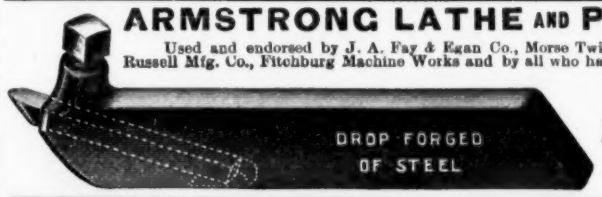

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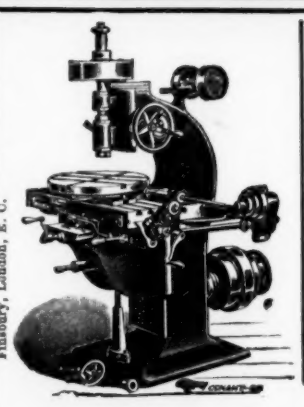

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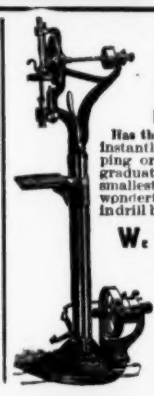

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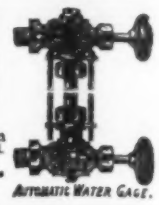

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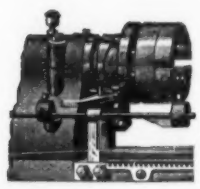

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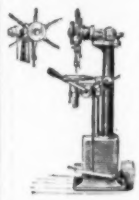

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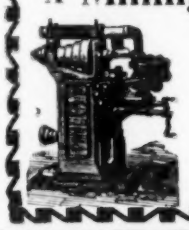

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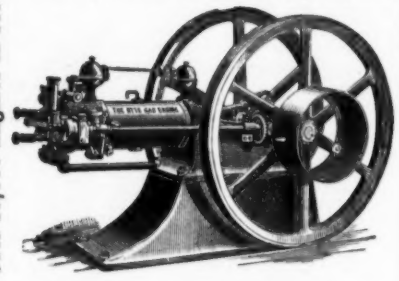

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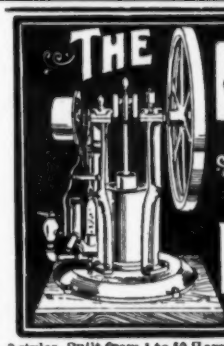

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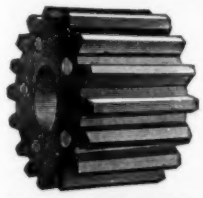

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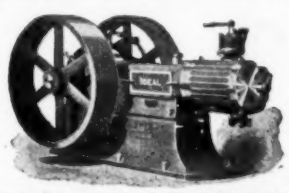

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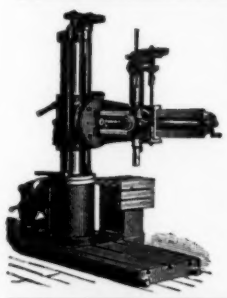

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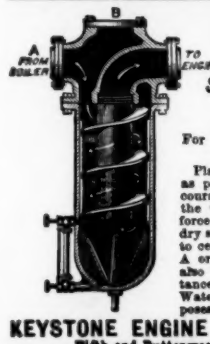

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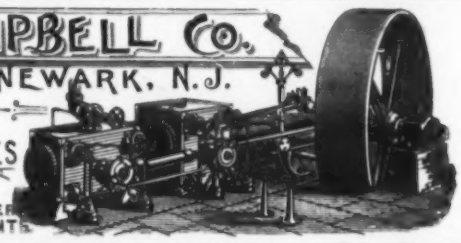

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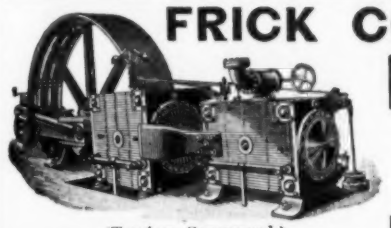

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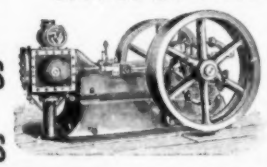

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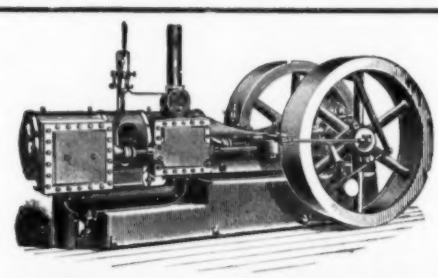

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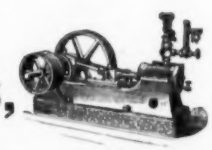

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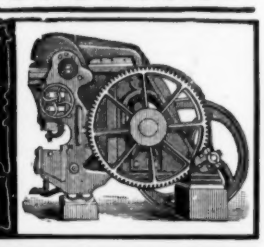

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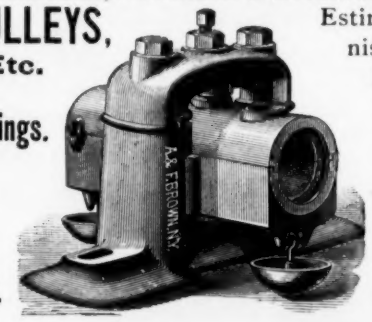

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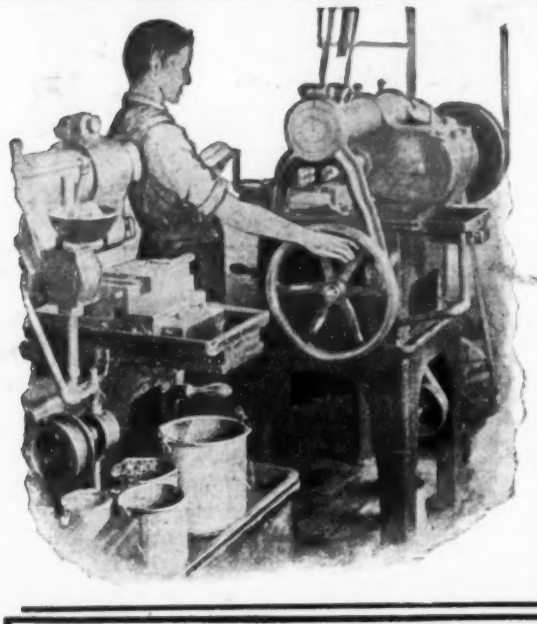

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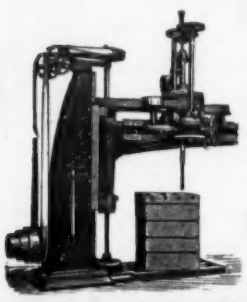

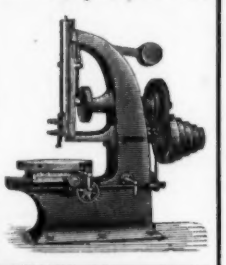

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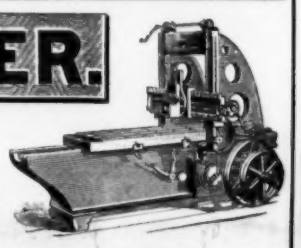

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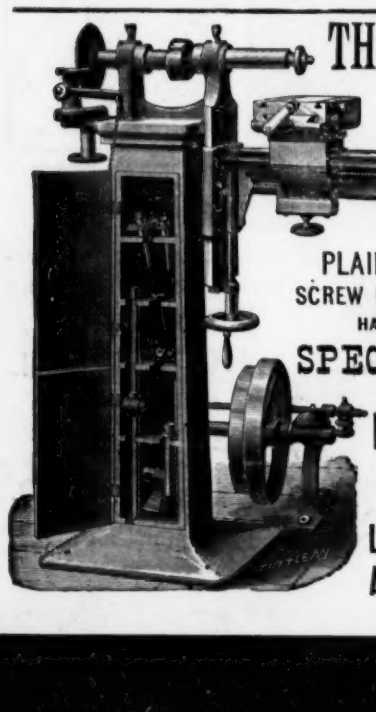

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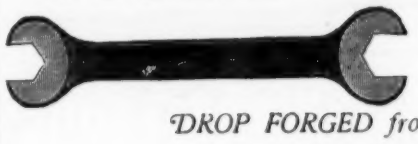

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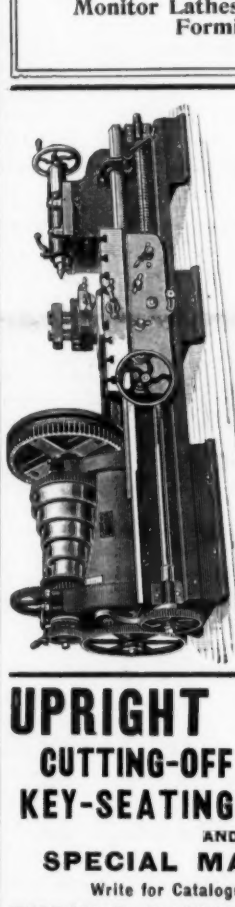

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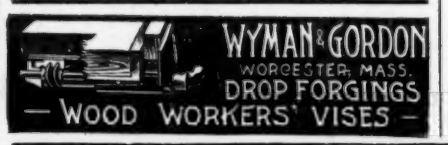

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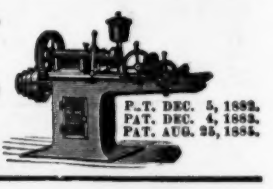

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